Math I-3&5

Activities

Add/Subtract Fractions

Focus on Fractions

Standard I:

Students will acquire number sense and perform operations with whole numbers, simple fractions, and decimals.

Objective 3:

Model and illustrate meanings of multiplication and division of whole numbers and the addition and subtraction of fractions.

Intended Learning Outcomes:

1. Use models to add and subtract simple fractions where one single digit denominator is 1,2, or 3 times the other.

Content Connections:

Math I-5; Problem solving

Math Standard I

Objective 3

Connections

Background Information

This activity is meant to follow a thorough introduction to fractions. Students should be comfortable with the concept of what a fraction is, specifically 1/2, 1/3, 1/4, 1/5, 1/6, 1/8, 1/9, 1/10 & 1/12. Students should be able to describe and show concrete representations of each of these fractions.

Research Basis

Meagher, M., ERIC Digest, June 2002, "Teaching Fractions: New Methods, New Resources"

It doesn't matter if fractions are introduced as counting or as measurements. Teachers often fail to recognize or utilize prefractural knowledge. Preschoolers recognize what "1/2" is. We often take an adult centered approach rather than a child centered approach to teaching children about fractions. Knowledge of fractions falls into three strands: 1) procedural knowledge, 2) factual knowledge and 3) conceptual knowledge.

Caine, R.N. & Caine, G. (1994) "Making Connections: Teaching and the Human Brain"

Brain research demonstrates that the more senses used in instruction, the better learners will be able to remember, retrieve, and connect the information in their memories. By incorporating realistic, interdisciplinary activities that involve more than one of the child's senses, memory pathways become more easily accessed and cross-referenced for future use.

Invitation to Learn

Ask students if they are only called by one name. Have students discuss in small groups or share with the whole class different names people call them. Give the example of someone named "Richard". My friend Richard was called "Rich" by his girlfriend, "Rick" by his coach, "Ricky" by his Mom and "Richard" when he was in trouble. A boy named Robert was called a lot of different names, but they weren't bad names, just different names people called him. He was still the very same person even though he was known as Rob, Robby, Bob & Bobby—lots of names for the same person. Well, that's how it is with FREIDA FRACTION. Her friends call her ½, her Mom calls her 2/4, her Dad calls her his little 3/6 and Grandma calls her 4/8. Her teacher calls her 5/10 and on special occasions she is known as 6/12.

Instructional Procedures

Materials

- ❑ *Frieda Fraction*
- ❑ 1/2 Transparency
- ❑ Pattern Blocks
- ❑ Paper Folding Squares
- ❑ *Fraction Tree*
- ❑ *I've Got your Fraction*

1. Do the paper folding squares activity with students to demonstrate equivalent fractions.
2. Use *pattern blocks* and *Pattern Block Equivalent Fractions* worksheets.
3. When students seem to understand basic equivalent fractions, move on to *Fraction Tree* with pattern blocks. You may want to demonstrate with the whole class, them move on to working in small groups or partners and then independently.
4. Use *I've Got Your Fraction* game for review.

Assessment Suggestions

- Pre-assess each child's concept and understanding of fractions and equivalent fractions. This could be done in a journal writing experience. When was the first time you remember learning what"1/2" is? Write about it.
- Assess student understanding by checking their paper folding experience and *Fraction Tree* activities.
- Orally assess a student's understanding of equivalent fractions by having them describe to you how to know if fractions are equal.

Curriculum Extensions/Adaptations/ Integration

- Have advanced learners make Festive Fraction Books with examples of other equivalent fractions.
- Have matching game cards with equivalent fractions for students to play with a partner or in a concentration or war game on their own.

Family Connections

- Have students use fraction cards to play concentration, fish or war with parents at home.
- Have Student create a personal Frieda Fraction and different equivalent fractions. Make it into a poster or a short book.

Additional Resources

Web sites

http://mathforum.org/paths/fractions

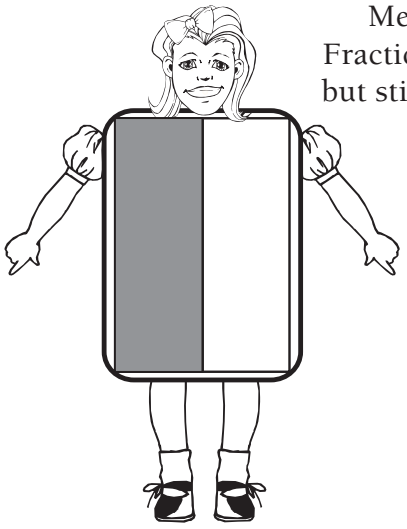
http://www.coolmath4kids.com/fractions/

http://www.edhelper.com/fraction.htm

http://www.math.com/homeworkhelp/HotSubjects.fractions.html

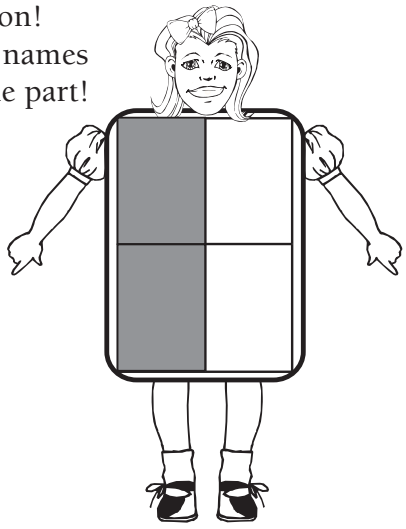
Frieda Fraction

Meet Freida Fraction!
Fractions have lots of names
but still name the same part!



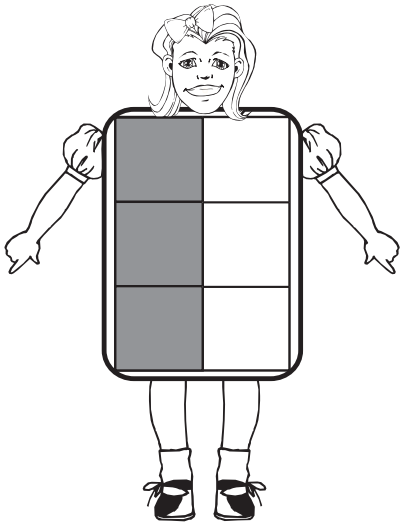
Friends
call her

$\frac{1}{2}$



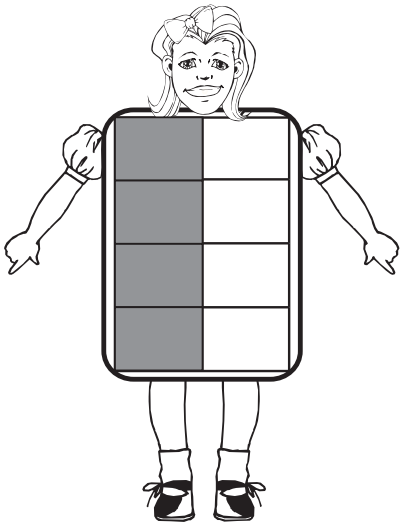
Mom
calls her

$\frac{2}{4}$



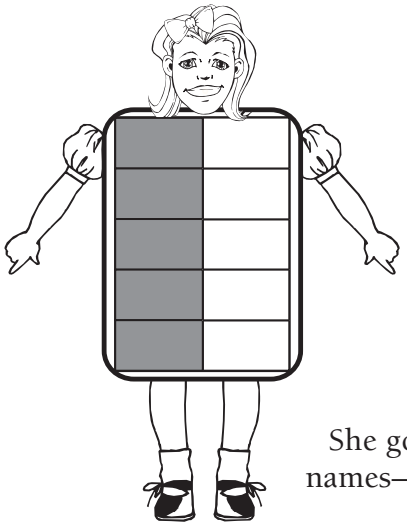
Dad
calls her

$\frac{3}{6}$



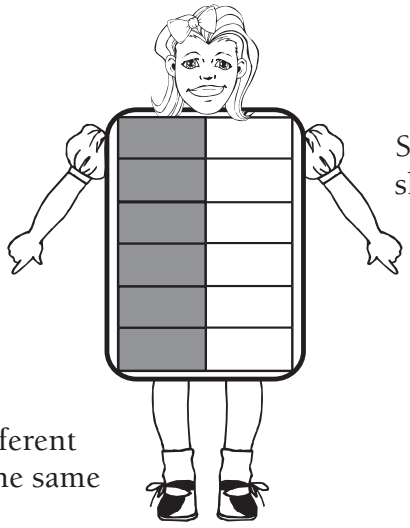
Grandma
calls her

$\frac{4}{8}$



Teacher
calls her

$\frac{5}{10}$

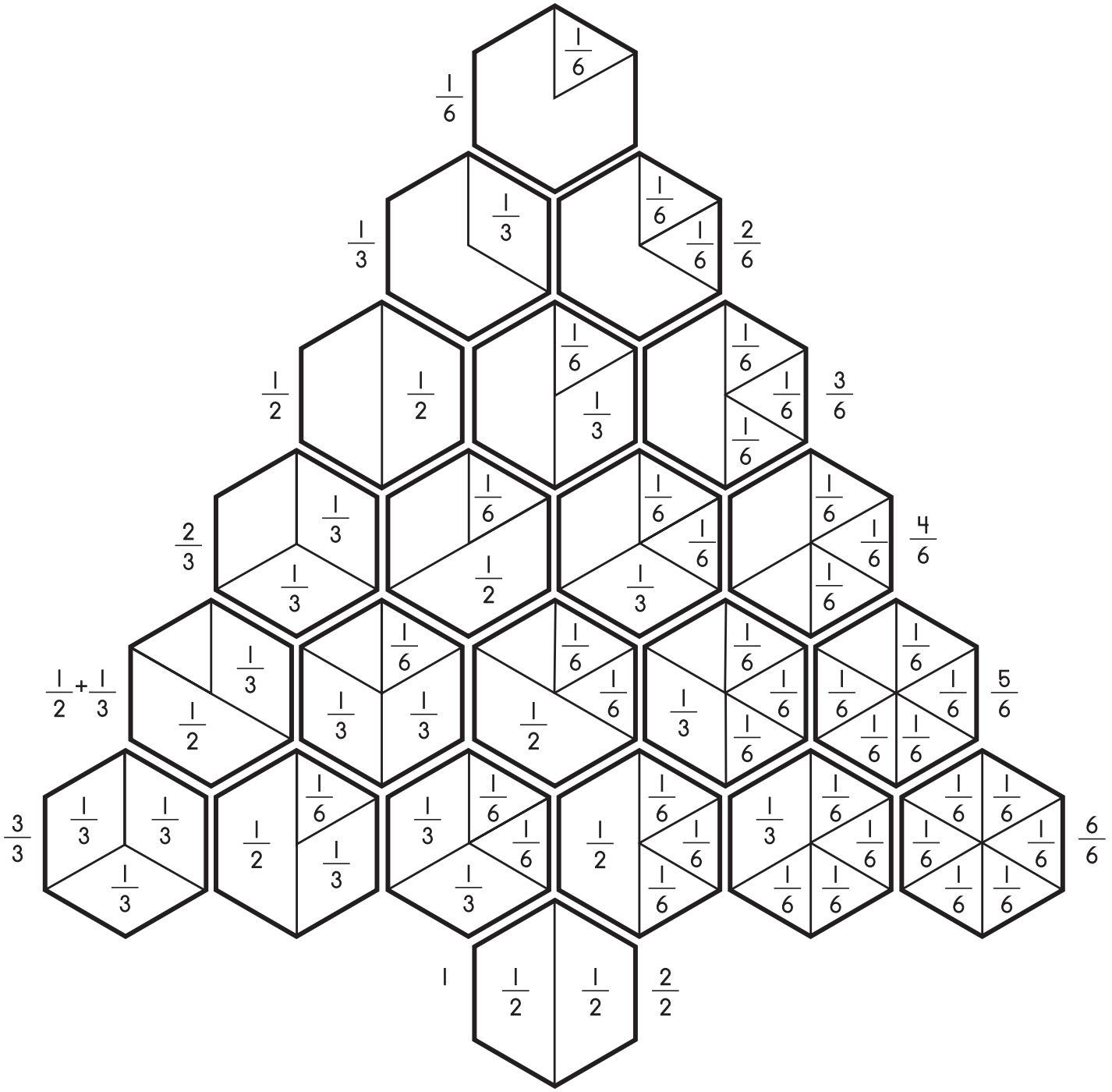


Sometimes
she's called

$\frac{6}{12}$

She goes by lots of different
names—but she's still the same
fraction!

Fraction Tree



I've Got Your Fraction – Game Cards

$\frac{1}{2}$	$\frac{2}{4}$	$\frac{3}{6}$
$\frac{4}{8}$	$\frac{5}{10}$	$\frac{6}{12}$
$\frac{1}{3}$	$\frac{2}{6}$	$\frac{3}{9}$

$\frac{4}{12}$	$\frac{1}{4}$	$\frac{2}{8}$
$\frac{3}{12}$	$\frac{1}{4}$	$\frac{2}{8}$
$\frac{3}{12}$	$\frac{1}{5}$	$\frac{2}{10}$

$\frac{1}{6}$	$\frac{2}{12}$	$\frac{2}{3}$
$\frac{4}{6}$	$\frac{6}{9}$	$\frac{8}{12}$
$\frac{2}{4}$	$\frac{4}{8}$	$\frac{6}{12}$

$\frac{3}{4}$	$\frac{6}{8}$	$\frac{9}{12}$
$\frac{2}{5}$	$\frac{4}{10}$	$\frac{3}{5}$
$\frac{6}{10}$	$\frac{4}{5}$	$\frac{8}{10}$

$\frac{4}{6}$	$\frac{8}{12}$	$\frac{5}{6}$
$\frac{10}{12}$		

The Power of ONE!

Standard I:

Students will acquire number sense and perform operations with whole numbers, simple fractions, and decimals.

Objective 3:

Model and illustrate meanings of multiplication and division of whole numbers and the addition and subtraction of fractions.

Intended Learning Outcomes:

1. Develop a positive learning attitude toward mathematics.
2. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.

Content Connections:

Math I-5; Add and subtract simple fractions

Math Standard I

Objective 3

Connections

Background Information

Students should be familiar and comfortable with the concept of what a fraction is and easily recognize and name fractions from halves to twelfths. Students should be able to name equivalent fractions.

Research Basis

Furner, J. M., & Duffy, M. L., (2001). Equity For All Students in the New Millennium: Disabling Math Anxiety

Research by Jackson & Leffingwell (1999) has shown that only 7% of Americans have had positive experiences with math from kindergarten through college. Similarly, Burns (1998) has contended that 2/3 of US adults fear and loathe math. Whether it is 93% or 2/3 of Americans who have negative math experiences, a problem clearly exists.

As teachers of mathematics, we need to make the learning engaging, fun and varied. We need to individualize the learning and the assessing to best meet the needs of each student in our class.

Invitation to Learn

Have you ever wanted to be #1? How did you feel when you were #1? Did you feel pretty powerful? Pretty cool? Pretty Smart? Number ONE is the most powerful number! It can transform or morph into an infinite number of forms of itself. To morph or transform it must be in the "Magic Box". (The magic box is a rectangle

divided in the middle with a fraction bar.) This is kind of like Clark Kent went into a phone booth (a magic box) and came out as another form of himself ----Superman!

POWER of ONE Skit—Brave teachers of Math will come dressed in some superhero costume of their choice to represent the powerful #ONE! It would be great to have a large box (e.g., one you could fit into that would open and shut). On the outside of the box draw a fraction bar. Prepare ahead of time fraction posters that are equivalent to ONE (e.g., 2/2, 3/3, 4/4, 5/5 etc). ONE transforms himself or morphs into the superhero he is needed to be at any moment for any problem. Watch as he appears in his secret identity to save the day for adding or subtracting fractions! Appear with the fractions that are equal to ONE hung around your neck. Ham it up---the kids will love it and they will remember it!

Instructional Procedures

Materials

- ❑ *Egg Carton Fraction*
- ❑ *Equivalent ONES*
- ❑ *Magic Box*

1. Do Superhero Power of ONE skit. Include a costume if possible and your Magic Box (phone booth) to transform into other form of the number one.
2. Give each student the *Magic Box* worksheet. Discuss that any fraction that is written in the *Magic Box* must be equal to ONE and therefore it will have the same numerator and denominator.
3. Discuss and demonstrate with pattern blocks, fraction strips, etc. that when a fraction is multiplied by another fraction that equals ONE, the original fraction's value does not change; it is just renamed.
4. Point out that when you multiply using the *Magic Box* and a form of ONE, you are always being fair and just to all fractions because you do the same thing to the numerator that you do to the denominator. Everyone has been treated fairly and numerators and denominators have been multiplied (or divided) by the same number.
5. Do several examples with manipulatives all together, in small groups, and then have students do problems on their own.
6. Place 12 objects on every student's desk. Ask them to show you 1/2? How do you know this 1/2? Use your hand to cover 1/2. Now cover 2/2. What is another name for 2/2?
7. Separate your objects into thirds. How do you know they are separated into thirds? Cover 1/3 of the objects. Now cover 2/3 of the objects. Now cover 3/3. Count and show me 1/3, 2/3, 3/3. What is another name for 3/3?

8. Repeat with fourths, & sixths. What is another name for 4/4? What is another name for 6/6?
9. Review with *Equivalent ONES* worksheet.

Assessment Suggestions

- Do a cooperative learning assessment. After having been taught the concept, have students assess their learning through journal writing. Ask them to write a brief description of what the have done. Have them describe how the activities with the manipulatives and the idea of one being a powerful number changed their perception of finding equivalent fractions.
- One way of getting students to think about the material they have learned is to have them write their own test. Ask them to imagine that they are the teacher. Instruct them as to exactly what topics need to be covered (e.g., Why is one a powerful number). Explain and give examples of how one changes itself to different forms. You may want to require that the test include one problem-solving situation, a reasoning question, or other requirement. Ask students to solve their own problems.

Curriculum Extensions/Adaptations/ Integration

- Have advanced learners teach struggling students the concepts.
- For learners with special needs, have them draw a super hero ONE of their own to remind them about changing fractions to equivalent fractions using the Magic Box and the Power of ONE.
- Compare and contrast with how things transform or change in science (e.g., rocks change from sedimentary to metamorphic, to igneous, etc). Have students brainstorm other things in nature and in life that are powerful because of their ability to change.

Family Connections

- Have students teach their parents or a sibling about the Power of ONE. Give extra credit for those that do this. If a student can teach the concept to someone else, then they truly understand. Have the make up their own problems to work with parents. Have parents sign and return the note for credit.

- Have students work with someone in their family to use the Power of ONE in a real life situation (e.g., recipes and fractions). Write about it in their journal and share with the class.

Additional Resources

Books

Painless Fractions, by Akyece B. Cummings; ISBN 10:0-7641-3439-6

Articles

Hecht, Steven Alan. (1998.) Toward an Information-Processing Account of Individual Differences in Fraction Skills. *Journal of Educational Psychology*. *90*. 545-59.

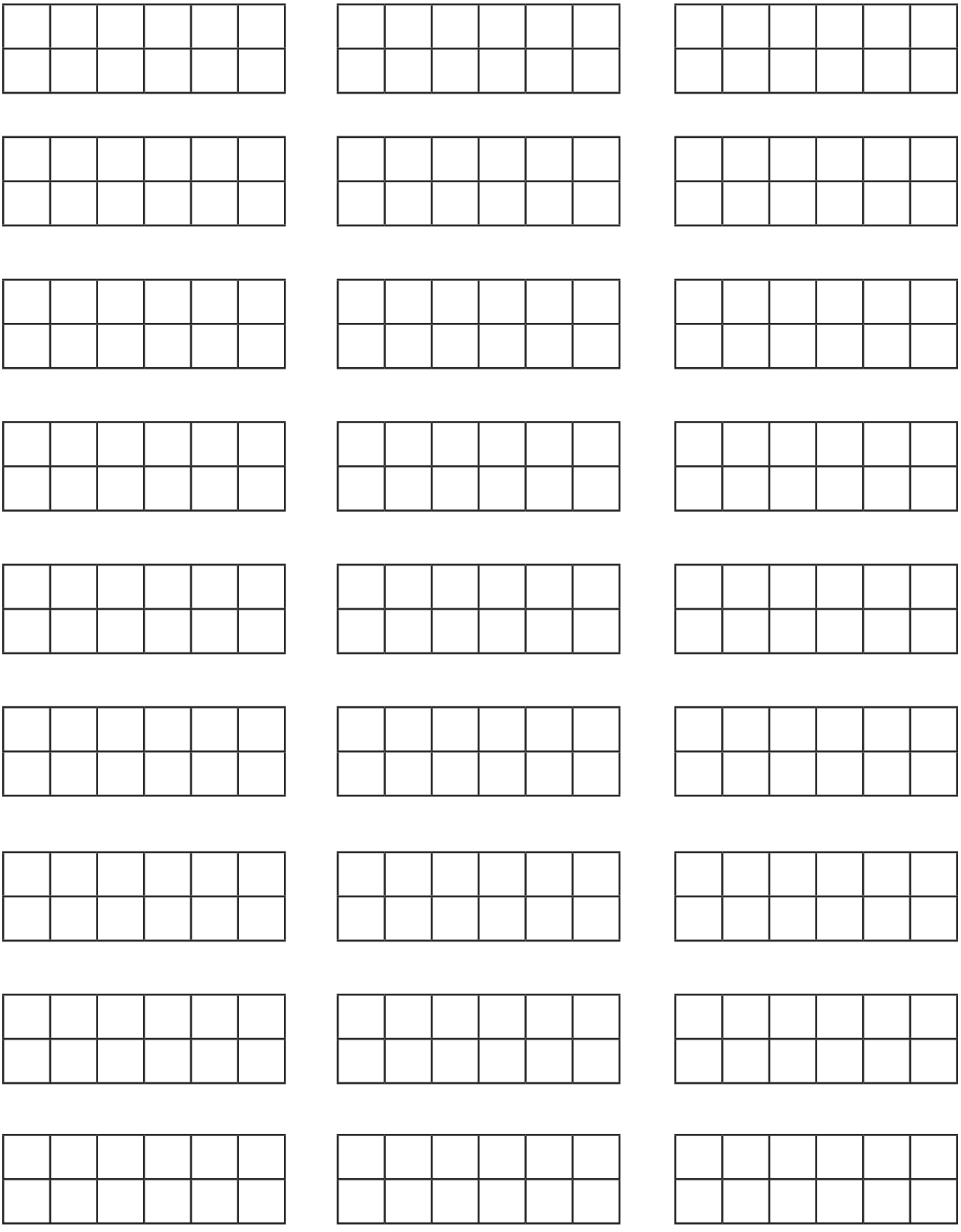
Web sites

http://www,visualfractions.com/

http://www.funbrain.com\fract

http://www.visualfractions.com/

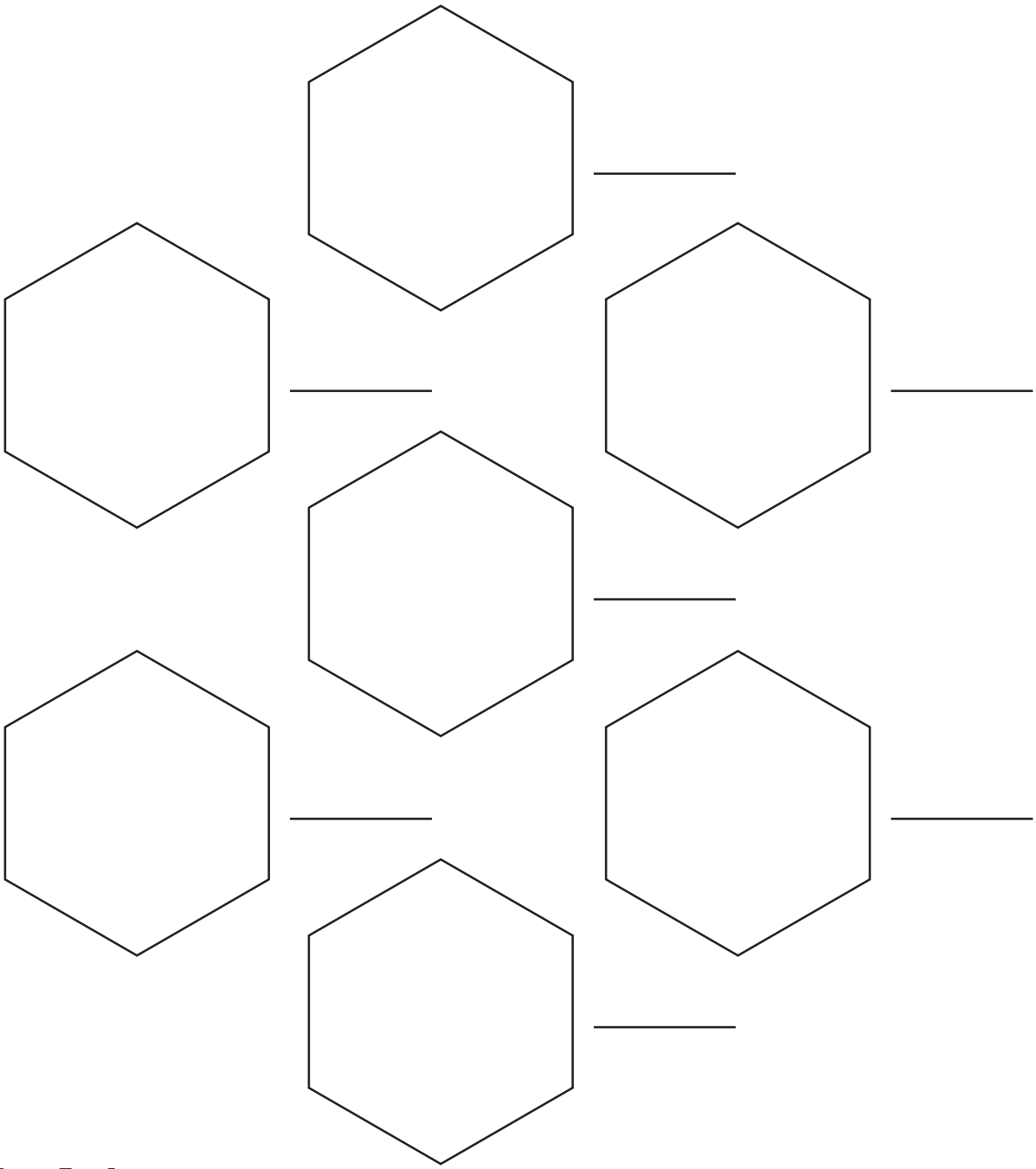
Egg Carton Fractions (blank)



Name _____ Date _____

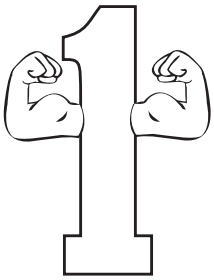
Equivalent Ones

Use pattern blocks to show different ways to equal 1. Trace your patterns for equivalent ones on the hexagons and write a fraction that is equivalent to 1 on the line.

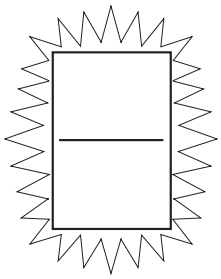


Have Fun!

Magic Box



Powerful One goes into the magic box and transforms into a fraction with the same numerator and denominator—it still equals 1! Complete the worksheet.



1. $\frac{2}{3} \times \frac{\square}{\square} = \frac{\quad}{9}$	2. $\frac{4}{5} \times \frac{\square}{\square} = \frac{\quad}{10}$	3. $\frac{1}{4} \times \frac{\square}{\square} = \frac{\quad}{12}$
4. $\frac{1}{2} \times \frac{\square}{\square} = \frac{\quad}{10}$	5. $\frac{1}{3} \times \frac{\square}{\square} = \frac{\quad}{6}$	6. $\frac{3}{4} \times \frac{\square}{\square} = \frac{\quad}{8}$
7. $\frac{1}{3} \times \frac{\square}{\square} = \frac{\quad}{9}$	8. $\frac{1}{2} \times \frac{\square}{\square} = \frac{\quad}{8}$	9. $\frac{2}{5} \times \frac{\square}{\square} = \frac{\quad}{1}$
10. $\frac{3}{4} \times \frac{\square}{\square} = \frac{\quad}{12}$	11. $\frac{1}{2} \times \frac{\square}{\square} = \frac{\quad}{6}$	12. $\frac{2}{3} \times \frac{\square}{\square} = \frac{\quad}{7}$

Delightfully Different Fractions!

Math Standard I

Objective 5

Connections

Standard I:

Students will acquire number sense and perform operations with whole number, simple fractions, and decimals.

Objective 5:

Compute problems involving multiplication and division of whole numbers and addition and subtraction of simple fractions and decimals.

Intended Learning Outcomes:

1. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems..

Content Connections:

Math I-3; Model addition and subtraction of fractions.

Background Information

Students should be familiar with the concept of fraction and that a fraction is obtained when a whole is partitioned. When dealing with fractions, partitions must be of equal size. Students should understand that the total amount of material is not affected by partitioning.

The more partitions the whole is divided into, the smaller the pieces. The size of the partitions also depends on the size of the whole.

Students should realize that every fraction has an infinite number of names. It should also be understood that when a whole is partitioned, the numerator and the denominator are increased by the same factor. Students should be familiar with equivalent fractions and feel comfortable adding and subtracting fractions with the same denominators.

Research Basis

Jensen, E. (1999). Teaching with the Brain in Mind. *Association for Supervision and Curriculum Development*, Alexandria, VA.

To our brain, we are either doing something we already know how to do or we are doing something new. Repetition of previous learning is likely to make the neuron pathways more efficient and therefore makes the brain more efficient. Reviewing what students already know on a regular, daily basis has great benefits. Reviewing and assessing what students already know about a concept helps them make more connections.

Memory is the only real evidence of learning. Lasting learning seems to be a function of the repeated electrical stimulations of a neuron. Quality education will provide multiple and varied explorations of concepts for increased connections and advanced memory.

Invitation to Learn

Play "Multiples Game". Have all students stand around the room. Call out a number from 1 to 12. When the number is called, students must get into groups the size of the number that was called and lock arms. Any one not in a group stands out. A different number is called each round. Call out numbers that are factors of 12 (2, 3, 4, 6, 12) to begin. Then call out a number that is not a factor of 12 (e.g. 5, 7, 8). Discuss with students why when you called out 5, why did classmates have to stand out. Why did no one leave the game when you called out 2 or 3 or 4 or 6 or 12? Everyone got into a new sized group but no one was eliminated. What could we deduce from this? Lead the discussion to multiples and what numbers divide evenly into 6, 8, 9 & 12.

Instructional Procedures

When denominators are DELIGHTFULLY DIFFERENT (like apples & oranges), you must find a common denominator before you can add or subtract the fractions. This is like mixing the fruit together in a fruit salad!

1. Sing *Fraction Song*.
2. Fraction Masquerade—Did you know that fractions wear masks? They wear masks every day of the week, not just on Halloween. You often put masks on fractions to make them easier to add or subtract. These masks come out when the fraction is renamed so it can be added or subtracted.
3. Give each student their 12 small objects. Have them separate into halves, thirds, fourths, sixths and twelfths using their egg cartons. Although they can show halves, thirds, etc. in many different ways, it is easier to identify the fractional part if they put objects close together, side by side. Discuss multiples.
4. Complete *Egg Carton Fractions* worksheet. Have students use their objects and egg cartons to work out problems.

Materials

- ❏ Egg cartons
- ❏ Small objects
- ❏ *Egg Carton Fractions*
- ❏ *Pattern Block Equivalent Fractions*
- ❏ *Fruit Salad*
- ❏ *Fruit Salad Fractions*
- ❏ Overhead fraction pieces
- ❏ Pattern Blocks
- ❏ *Fraction Song*

5. Have students explore with pattern blocks and come up with equivalent fractions. Remind them of the Power of ONE and the magic box as a way of creating equivalent fractions.
6. Work with students to find common denominators for basic fractions using the pattern blocks.

Assessment Suggestions

- Allow students to use pattern blocks, an egg carton, or fraction bars when testing.
- For struggling students who stress over a paper and pencil assessment, have them demonstrate with one of their manipulatives and describe orally how they add or subtract fractions with different denominators.

Curriculum Extensions/Adaptations/ Integration

- Using the fractions that have different denominators, have advanced students write and illustrate their own book about what could happen to a fourth grader during the day.
- List adaptations for learners with special needs.
- Include ideas for integration for other curricular areas (use appropriate subject area headings).

Family Connections

- Have students do the *Fruit Salad* worksheet at home with a parent. Let them teach their parent, older brother or sister or other adult about common denominators and the adding and subtracting of fractions. Have parents sign and return worksheet for a small reward or extra credit.
- Let students check out a set of pattern blocks to take home to teach a parent to find common denominators using pattern blocks. Have them do one worksheet (have parents sign) and then have them come up with an addition or subtraction problem of their own using pattern blocks. Give extra credit for those who return the worksheet signed.

Additional Resources

Books

The Doorbell Rang, by Pat Hutchings, ISBN978-0-688-09234-4

Reys, R. E., Suydam, M. N., and Lindquists, M. M. (1995). ***Helping Children Learn Mathematics, 4th ed.*** Needham Heights, MA: Allen and Bacon.

Web sites

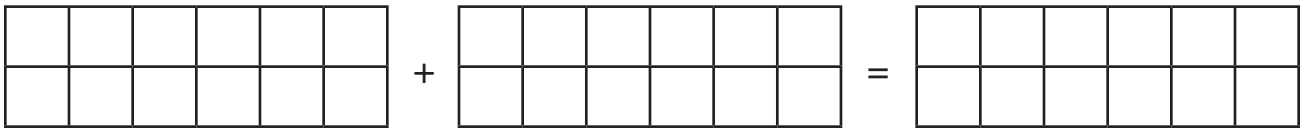
http://www.aplusmath.com/Flashcards/fractions-mult.html

http://math.rice.edu/-lanius/Patterns/

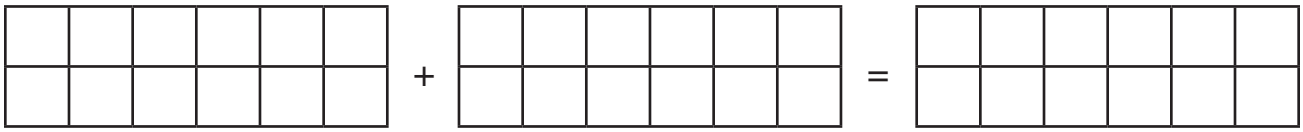
http://www.highwired.com/Classroom/Project/0,2069,23713-68258,00.html

Egg Carton Fractions

1. 1/2 + 1/3 =

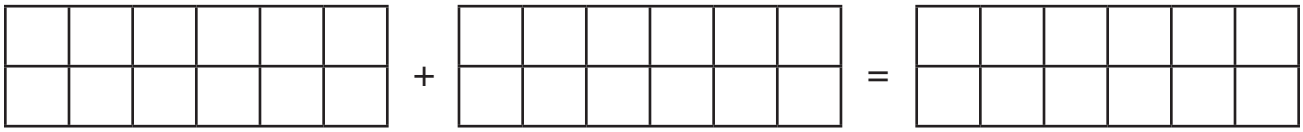


2. 1/2 + 1/4 =

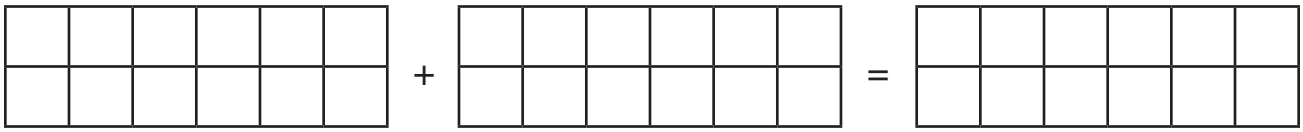


3. 1/4 + 1/3 =

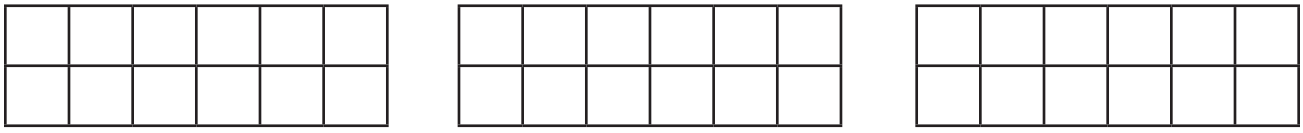
4. 2/3 + 1/6 =



5. 1/2 + 1/6 =



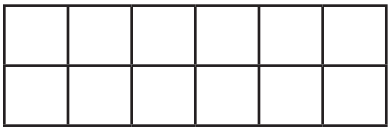
6. 5/6 + 1/12 =



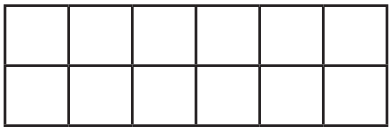
Egg Carton Subtraction - Missing Addend

Jan has 1/4 of a dozen eggs, but needs 2/3 of a dozen eggs to make custard. What part of a dozen does Jan need?

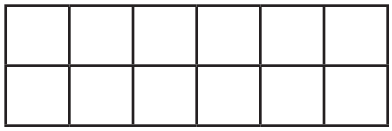
7. 1/4 + _____ = 2/3



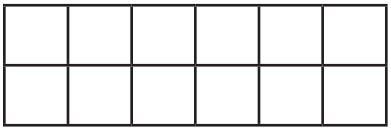
8. 2/3 + _____ = 3/4



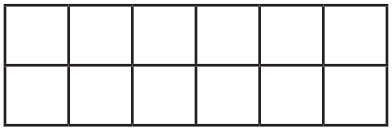
9. 1/2 + _____ = 5/6



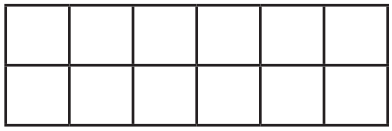
10. 1/4 + _____ = 5/12



11. 1/2 - 1/3 = _____



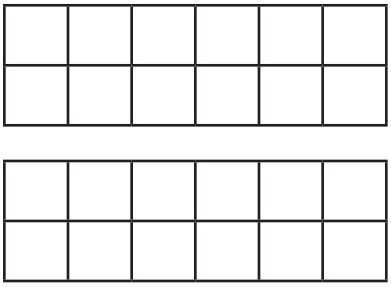
12. 3/4 - 2/3 = _____



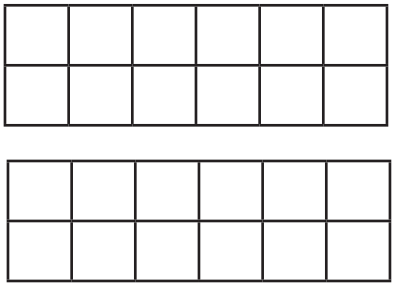
Subtraction - Comparison

Which is bigger and by how much?

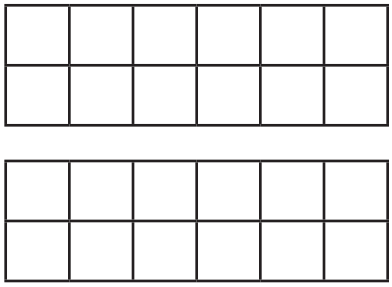
13. 2/3 - 1/4 = _____



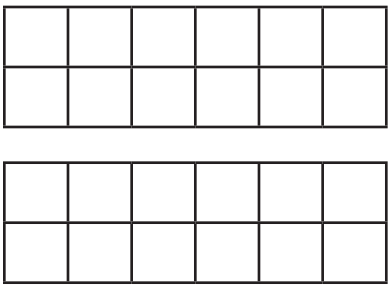
14. 3/4 - 2/3 = _____



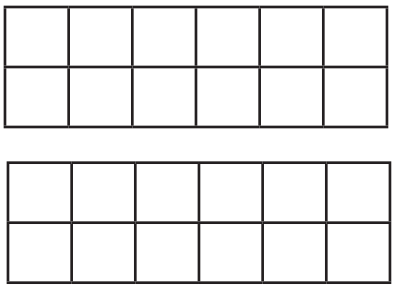
15. 5/6 - 1/2 = _____



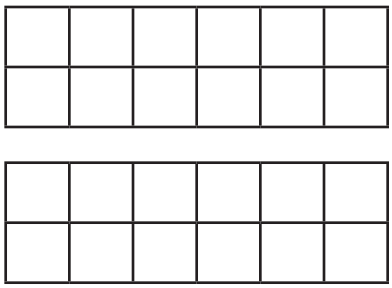
16. 5/12 - 1/4 = _____



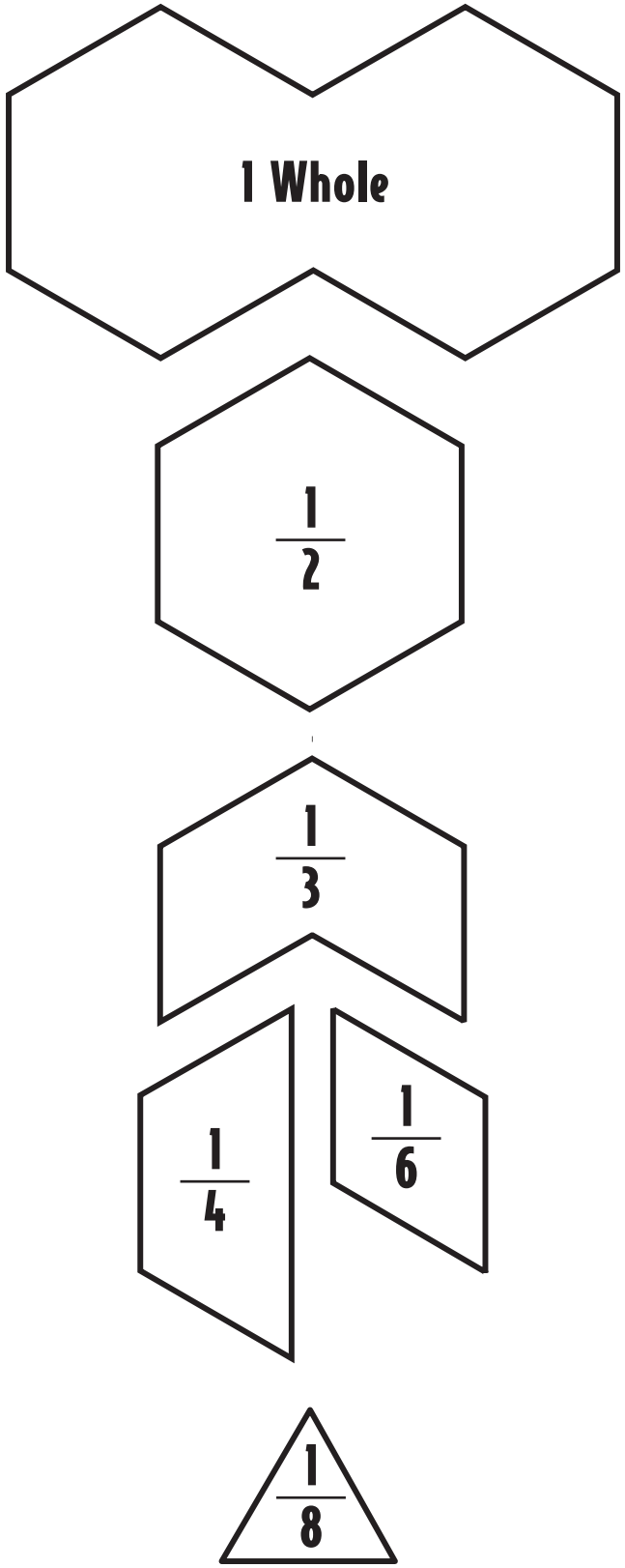
17. 1/2 - 1/3 = _____



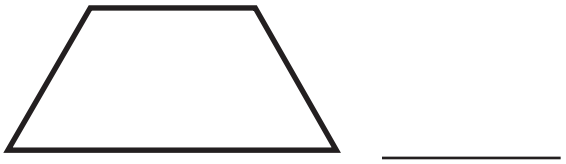
18. 3/4 - 2/3 = _____

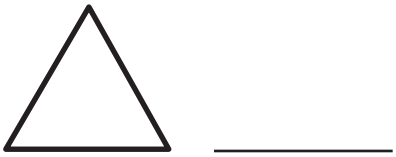


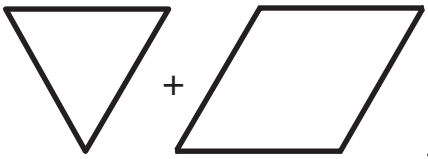
Pattern Block Equivalent Fractions

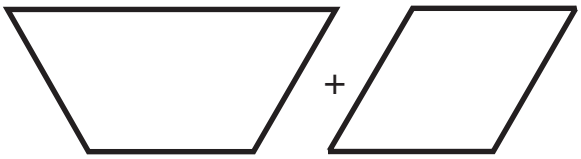


Pattern Block Equivalent Fractions

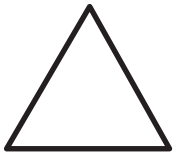


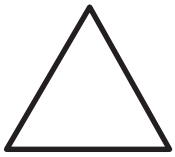
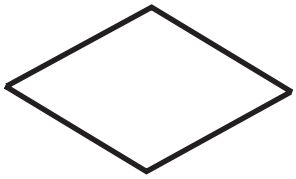


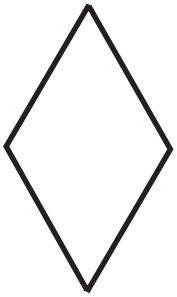
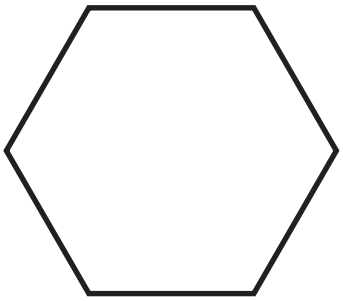


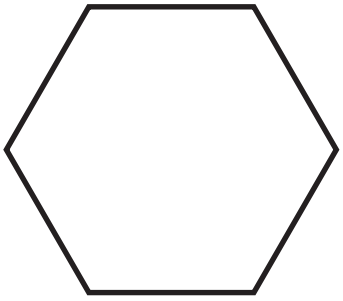


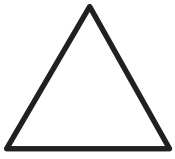
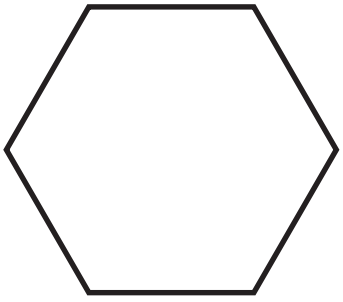
Pattern Block Equivalent Fractions

How many  **Cover (equal)**  **?** _____

How many  **Cover (equal)**  **?** _____

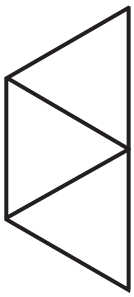
How many  **Cover (equal)**  **?** _____

How many  **Cover (equal)**  **?** _____

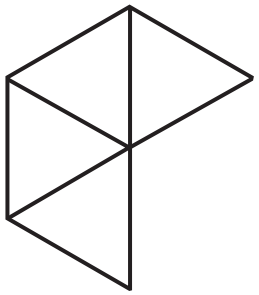
How many  **Cover (equal)**  **?** _____

Pattern Block Equivalent Fractions

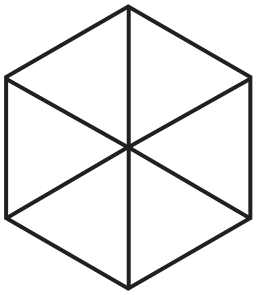
What is the largest piece that can fit in the pieces? How many times will it fit?



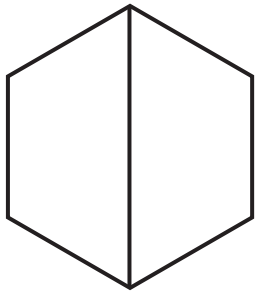
$\frac{3}{6} = ?$



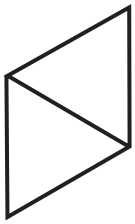
$\frac{4}{6} = ?$



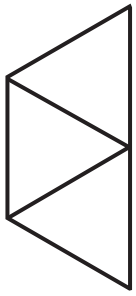
$\frac{6}{6} = ?$



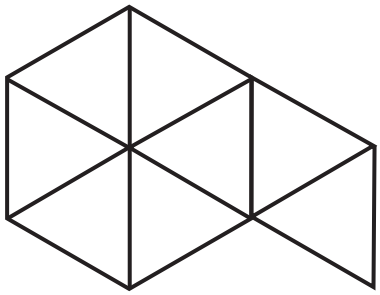
$\frac{2}{4} = ?$



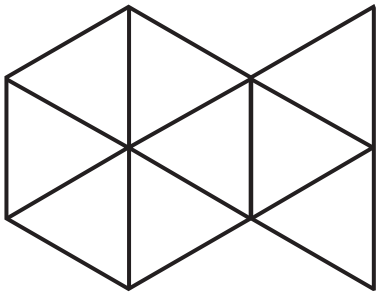
$\frac{2}{12} = ?$



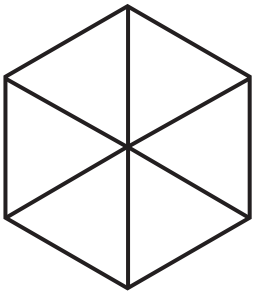
$\frac{3}{12} = ?$



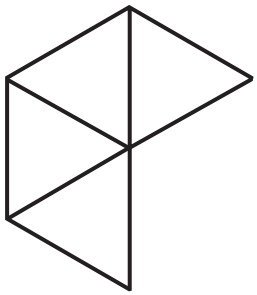
$\frac{8}{12} = \_\_\_$



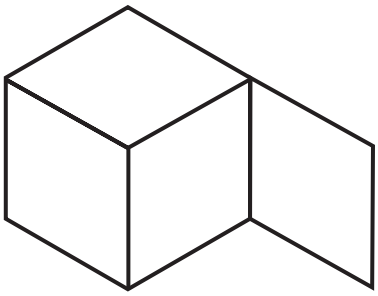
$\frac{9}{12} = \_\_\_$



$\frac{6}{12} = \_\_\_$

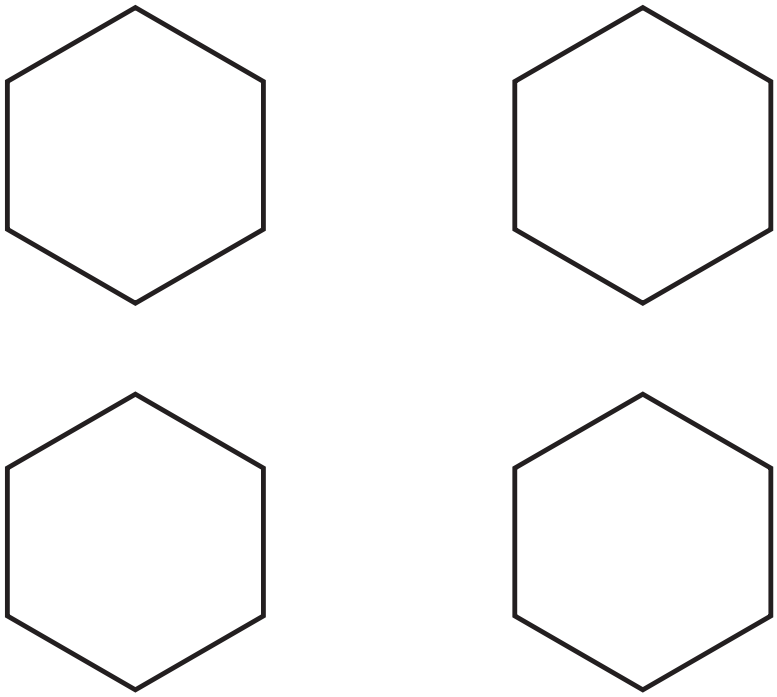


$\frac{4}{12} = \_\_\_$

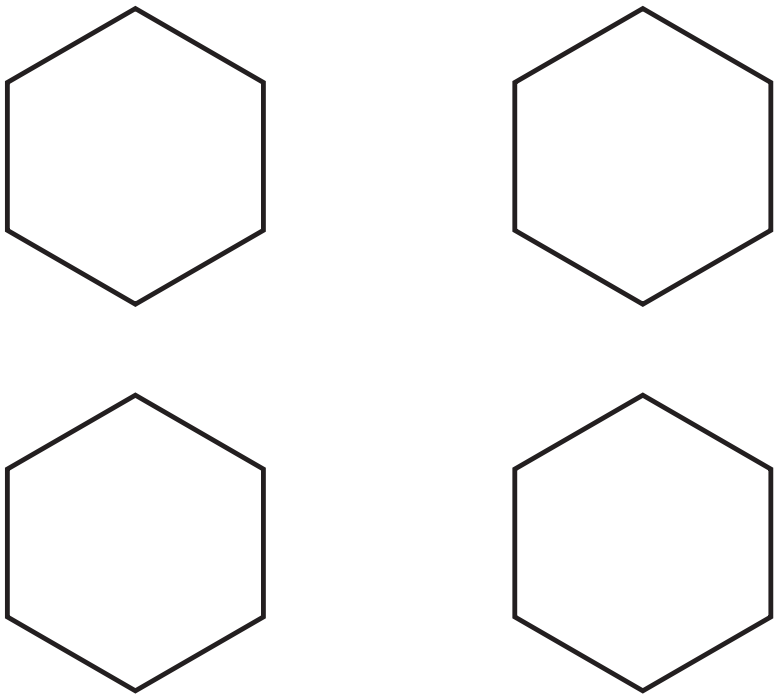


$\frac{4}{6} = \_\_\_$

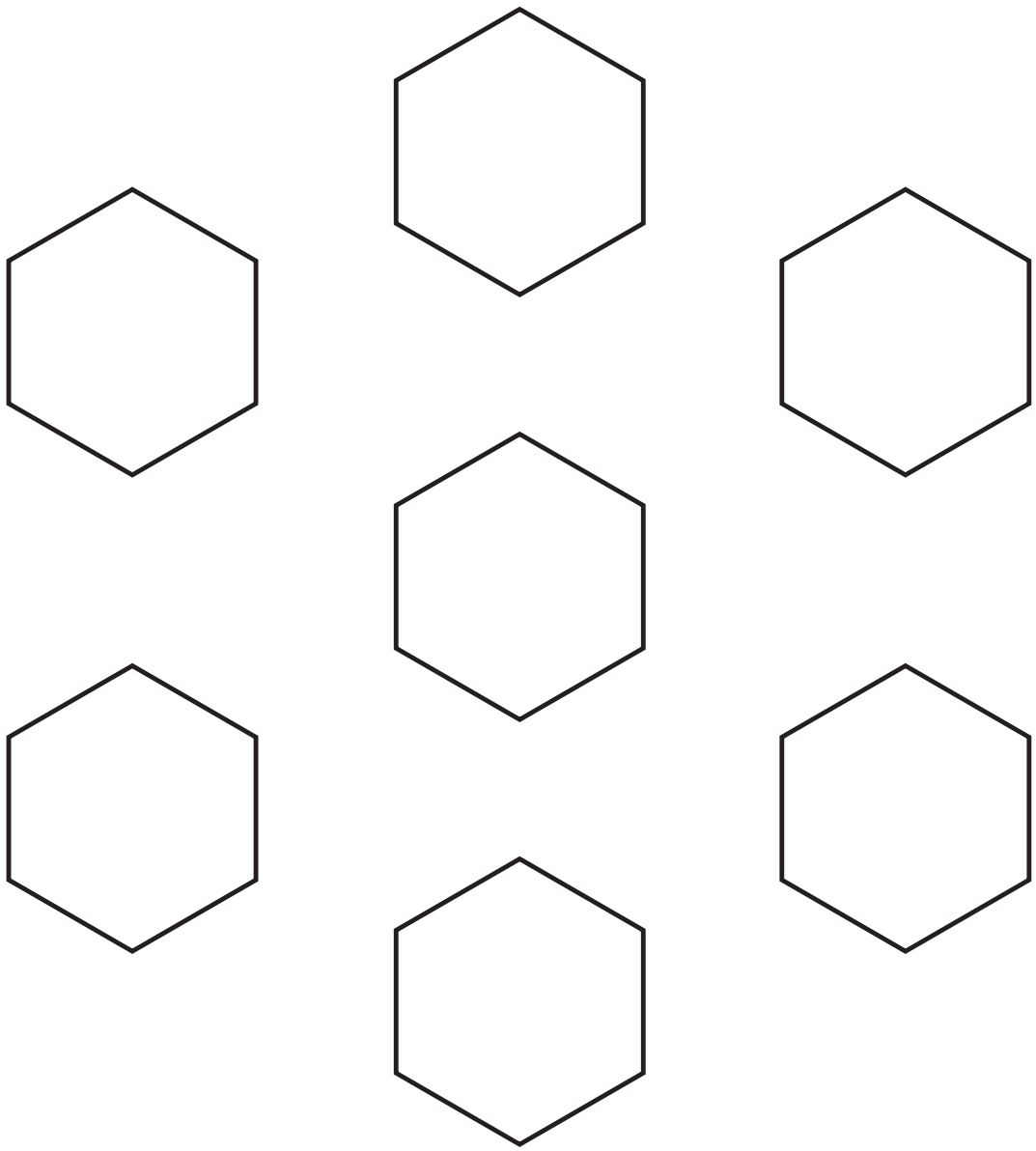
Show 4 different ways to show 4/4.



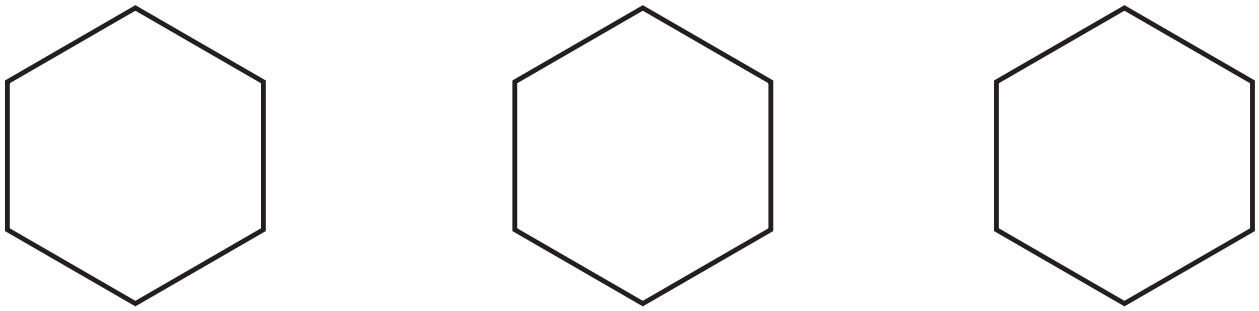
Show 4 different ways to show 4/4.



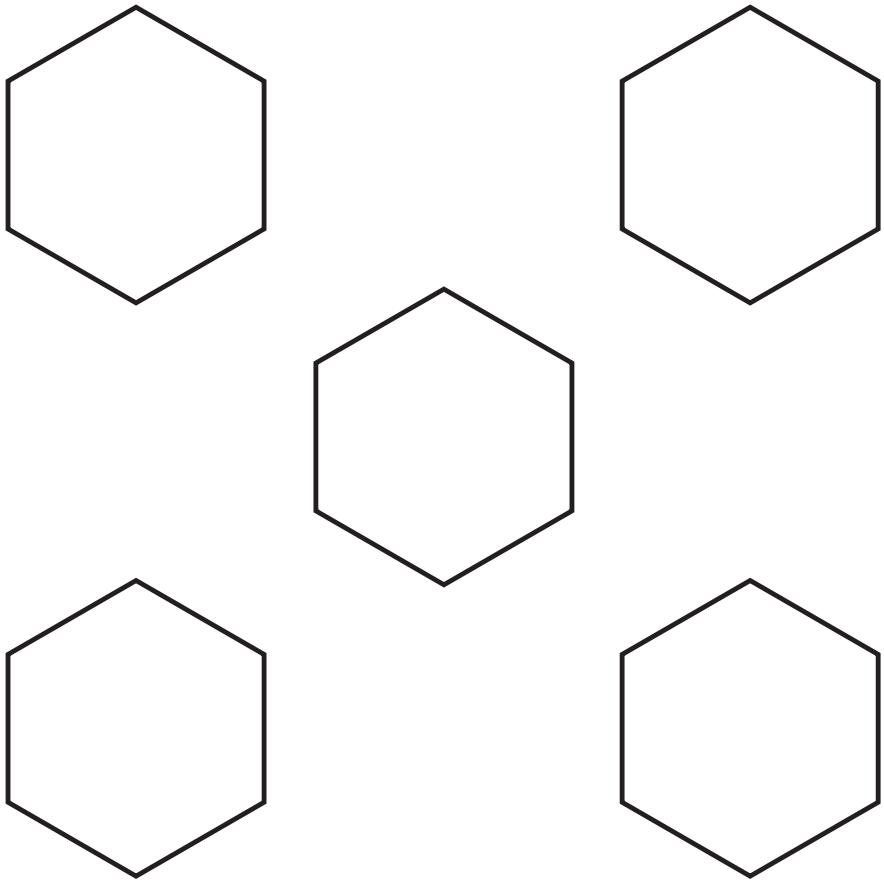
Show 7 different ways to show 6/6.



Show 3 different ways to show 3/6.



Show 4 different ways to show 4/4.



Show the following equations using Pattern Blocks:

- **Explain your answer to your neighbor**
- **Explain your answer in your journal**

$\frac{1}{6} + \frac{1}{3} = \frac{3}{6}$ or $\frac{1}{2}$

$\frac{1}{6} + \frac{2}{3} = \frac{5}{6}$

$\frac{2}{6} + \frac{1}{3} = \frac{4}{6}$ or $\frac{2}{3}$

$\frac{2}{6} + \frac{2}{3} = \frac{6}{6}$ or 1

$\frac{1}{6} + \frac{1}{2} = \frac{4}{6}$ or $\frac{2}{3}$

$\frac{3}{6} - \frac{1}{3} = \frac{1}{6}$

$\frac{5}{6} - \frac{2}{3} = \frac{1}{6}$

$\frac{4}{6} - \frac{1}{3} = \frac{2}{6}$ or $\frac{1}{3}$

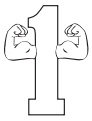
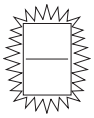
$\frac{6}{6} - \frac{2}{3} = \frac{2}{6}$ or $\frac{1}{3}$

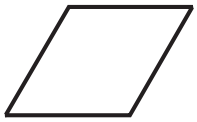
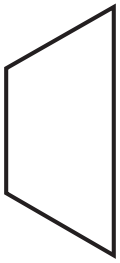
$\frac{4}{6} - \frac{1}{2} = \frac{1}{6}$

$\frac{5}{6} - \frac{1}{3} = \frac{1}{2}$

$\frac{1}{2} + \frac{1}{3} = \frac{5}{6}$

Adding & Subtracting with Pattern Blocks

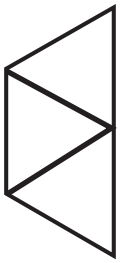
Use the power of  **and the Magic Box.** 

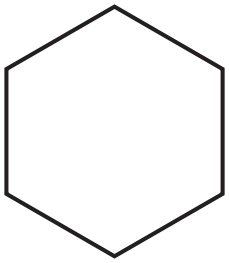
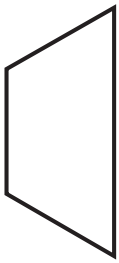
$\frac{1}{2} + \frac{1}{4}$  +  =

Rename

$\frac{1}{2}\square = \frac{1}{4}$

$\frac{1}{4}\square = \frac{1}{4}$

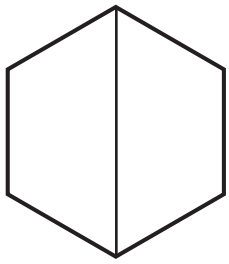
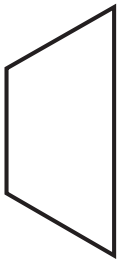
 +  =

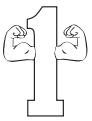
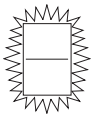
$\frac{1}{6} + \frac{1}{4}$  +  =

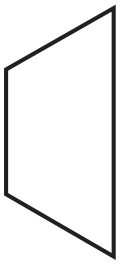
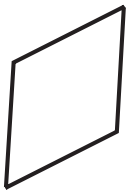
Rename

$\frac{1}{6}\square = \frac{2}{12}$

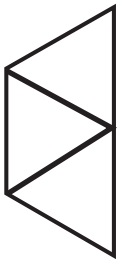
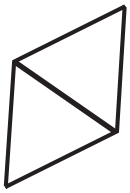
$\frac{1}{4}\square = \frac{3}{12}$

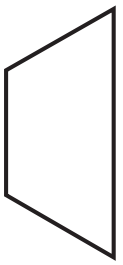
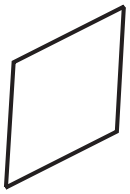
 +  =

Use the power of  **and the Magic Box.** 

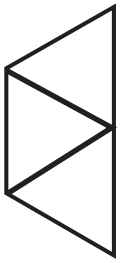
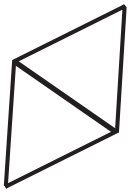
$\frac{1}{2} + \frac{1}{3}$  $+$  $=$

Rename

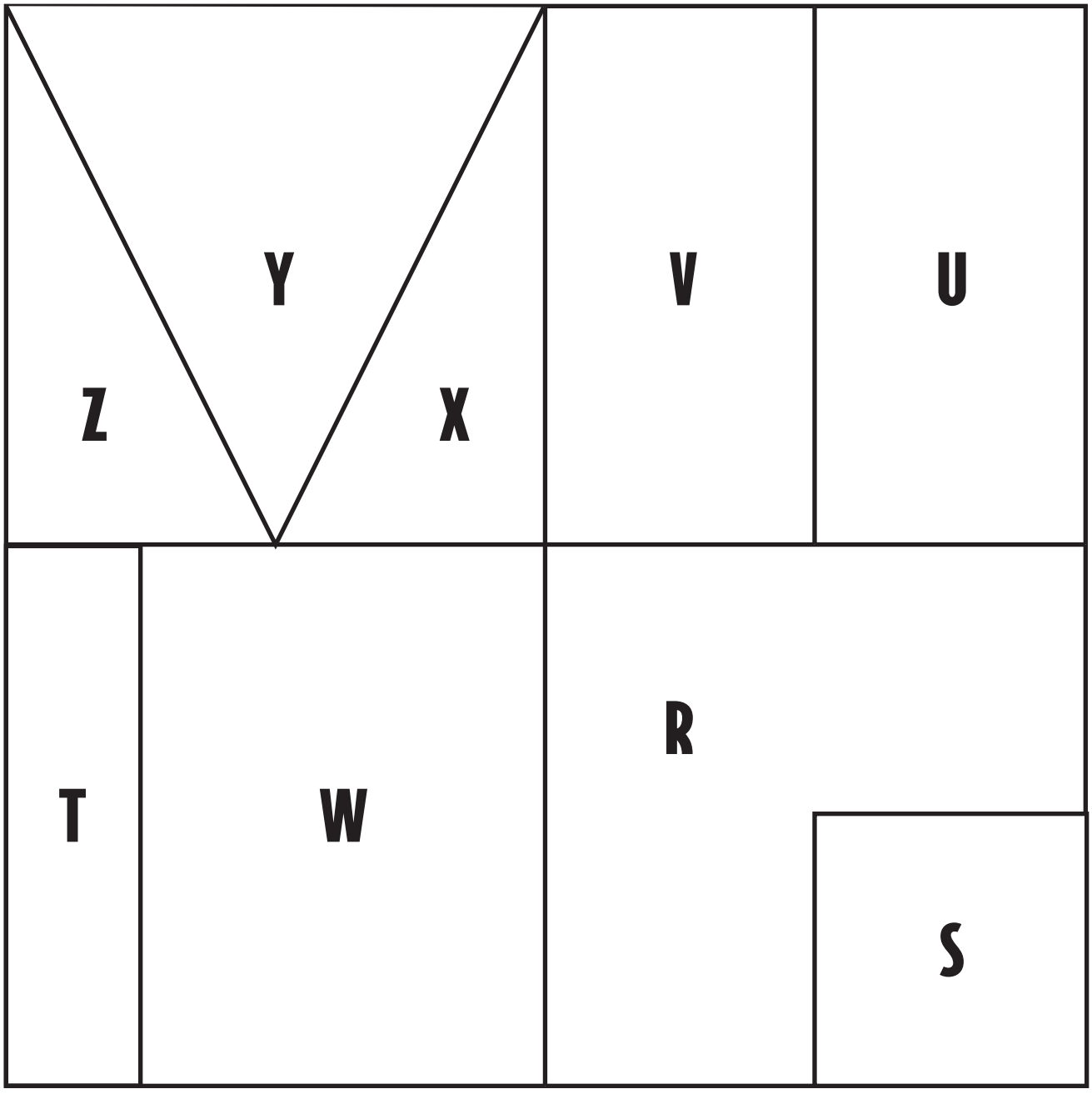
$\frac{1}{2} \square = \frac{3}{6}$  $+$ $\frac{1}{3} \square = \frac{2}{6}$  $=$

$\frac{1}{2} - \frac{1}{3}$  $-$  $=$

Rename

$\frac{1}{2} \square = \frac{3}{6}$  $+$ $\frac{1}{3} \square = \frac{2}{6}$  $=$

Square Fractions

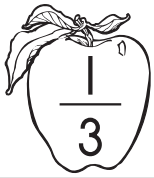
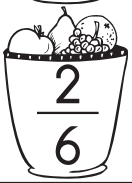


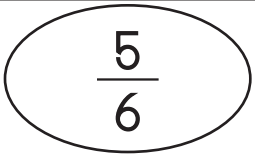
Name _____ Date _____

Fruit Salad

Home/School Connection: If you have Delightfully Different Denominators (like apples and oranges) you have to make Fruit Salad to add or subtract fractions!

1.  $\frac{3}{3}$ = 

\+  $\frac{2}{2}$ = 



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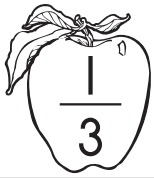
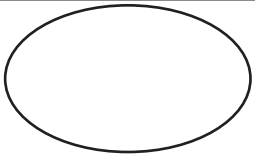
\+  = 



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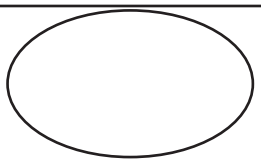

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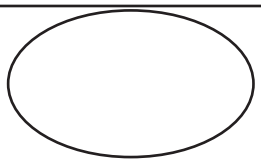

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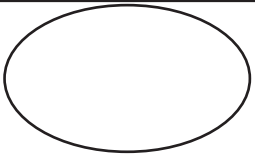


Parent Signature

Name _____ Date _____

Fruit Salad Fractions

Home/School Connection: If you have Delightfully Different Denominators (like apples and oranges) you have to make Fruit Salad to add or subtract fractions!

1. $\frac{1}{3}\square = \_\_$

   $-\ \frac{1}{6}\square = \_\_$

2. $\frac{1}{5}\square = \_\_$

   $+\ \frac{1}{2}\square = \_\_$

3. $\frac{1}{4}\square = \_\_$

   $+\ \frac{1}{3}\square = \_\_$

4. $\frac{2}{3}\square = \_\_$

   $+\ \frac{1}{6}\square = \_\_$

5. $\frac{1}{2}\square = \_\_$

   $+\ \frac{1}{4}\square = \_\_$

6. $\frac{5}{6}\square = \_\_$

   $+\ \frac{1}{12}\square = \_\_$

7. $\frac{5}{12}\square = \_\_$

   $-\ \frac{1}{4}\square = \_\_$

8. $\frac{3}{4}\square = \_\_$

   $-\ \frac{2}{3}\square = \_\_$

9. $\frac{2}{3}\square = \_\_$

   $-\ \frac{1}{4}\square = \_\_$

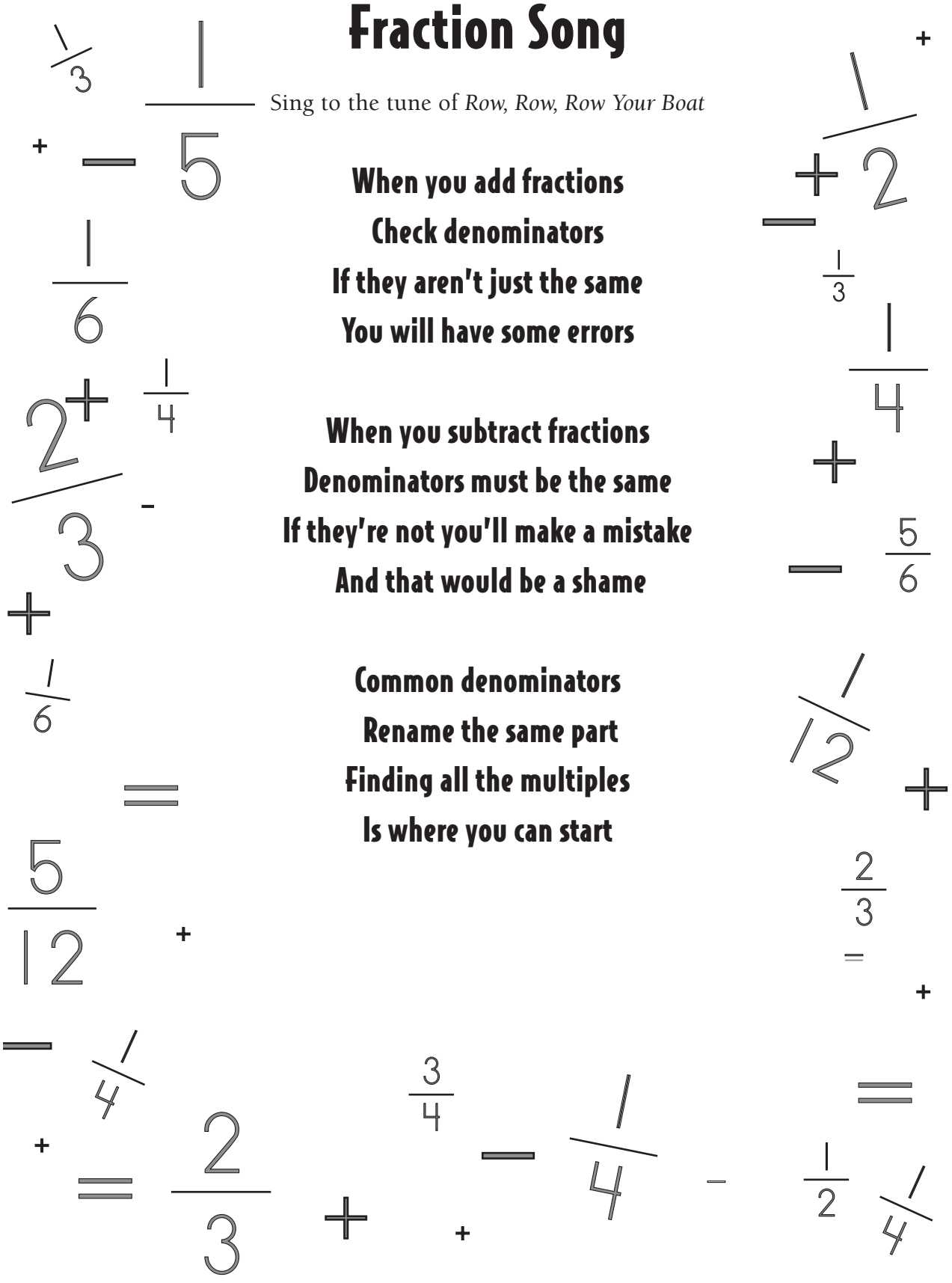
Fraction Song

Sing to the tune of *Row, Row, Row Your Boat*

When you add fractions
Check denominators
If they aren't just the same
You will have some errors

When you subtract fractions
Denominators must be the same
If they're not you'll make a mistake
And that would be a shame

Common denominators
Rename the same part
Finding all the multiples
Is where you can start



Science III-2

Activities

Weathering Soils

Take a Tumble

Science Standard III

Objective 2

Connections

Standard III:

Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by the soil.

Objective 2:

Explain how the processes of weathering and erosion change and move materials that become soil.

Intended Learning Outcomes:

1. Make simple predictions and inferences based upon observations.
2. Compare things and events.
3. Use instruments to measure length, temperature, volume, and weight using appropriate units.
4. Conduct a simple investigation when given directions

Content Connections:

Math IV-1; Measuring mass, length & volume

Background Information

Have you ever seen those bright, polished rocks in tourist shops? Have you wondered how they were made? Rock hounds use rock tumblers or rock polishers to make rough rocks smooth and shiny. By placing rocks in small barrels with grit and water and letting them tumble—much like clothes in your dryer at home—you can have them rub and grind against grit and each other to smooth their surfaces and knock off edges. It has been calculated that every 24 hours a rock is worked in a tumbler is equivalent to traveling 4.3 kilometers (2.7 miles) in a stream. With this in mind, rock tumblers are a great way to simulate mechanical or physical weathering in your own classroom.

At the most basic level, *weathering* is the process by which rock is broken down into smaller pieces, and *erosion* is how those smaller pieces (e.g., the tiny bits of rock and minerals that make up soil) are moved or carried away. Weathering can be divided into two types: *mechanical* or (*physical)* weathering, in which the chemical makeup of the rock is unchanged during the breakdown; and *chemical* weathering, in which a change occurs in the chemical makeup of the rock that then causes it to break down.

Start by providing rocks for the students that are of the same relative hardness on the Mohs scale of mineral hardness. Limestone, shale, or marble are good choices for our simulation because these rocks are made of particles that are well cemented but still soft enough to show weathering over a few days of tumbling. Harder rocks like jasper, agate, or tiger eye are typically tumbled, but take 3 to 4 weeks

to polish and smooth—much longer than you may have with your students. Students really take ownership for their rocks, and if a softer rock is placed in with hard rocks, it could tumble completely away.

Size of rocks also matters. Provide rocks that are slightly larger than a toy marble. A double barrel tumbler with 3 lb barrels (the weight the barrel can hold) will be sufficient for use with a class of students. Label the barrels and have half of your students place their rock in one barrel and the rest in the other. Have the students record in which barrel they placed their rock. In this way they will need to distinguish their rock from only the other rocks in their barrel rather than from the whole collection of rocks.

The students will also be asked to measure different characteristics of their rocks. They could measure their rock with a ruler but they may not be able to do so accurately enough to distinguish change in their rock's size. Calipers are used to measure three-dimensional objects and can be used by students to more accurately measure the width and thickness of their rock.

Measuring the volume of their rock could also be new for them. Placing their rock in a graduated cylinder with a specific amount of water and then calculating the amount of water that is displaced will provide students with the volume of their rock.

Research Basis

Chesbro, R., (2006). Using Interactive Science Notebooks for Inquiry-Based Science. *Science Scope*. 29(3) 30-34.

The interactive science notebook is an opportunity for students to create and use a notebook that represents their science learning throughout the year. Interactive science notebooks enhance learning by encouraging students to write across the curriculum and promote personal connections to learning.

Klentschy, M., (2005). Science Notebook Essentials. *Science & Children*.

This article focuses on the effective components of student science notebooks and their use as an effective teaching tool to assist students in developing a deeper *understanding of science content*.

Invitation to Learn

Give each student a rock and tell them that they are going to play an identification game with their rocks. Each of them will need to describe their rock in detail in their journal so that they can identify it when it is put with the rocks from the other members of the class. Ask what type of characteristics they could use to identify their rocks.

Have them identify the visual characteristics such as color, texture, shape and distinguishing marks. After they have done this have them use the calipers to measure the length and width of the rocks. Use a scale to measure the mass of the rock. And then have them measure the volume of their rock using a graduated cylinder with a specific amount of water inside.

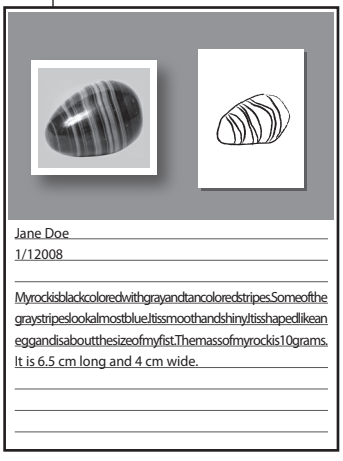
After they have identified their rock, have them team up with three other students to take a picture of their rocks placed on the *Photo Mat* (see blackline masters.). Four students will place rocks on the 4 sections of one photo mat. One picture will be taken of the photo mat; after it is printed the picture will be cut four ways.

Have the students place their rocks into the rock tumbler with 4 tablespoons of grit and enough water to fill the barrel two-thirds to three-fourths of the way. Seal the containers and begin the tumbling process.

When disposing of the used grit, do not pour it down a sink drain. The grit is heavy and will clog the sink and make it difficult to unclog.

Materials

- ❏ *Photo Mat*
- ❏ Rock tumbler
- ❏ Silicone Carbide Grit
- ❏ Rocks
- ❏ Calipers
- ❏ Scale or balance
- ❏ Graduated cylinders
- ❏ Camera
- ❏ Photo mat
- ❏ Student journals
- ❏ Colander
- ❏ Dish pan



Jane Doe
1/12008

My rock is black colored with gray and tan colored stripes. Some of the gray stripes look almost blue. It is smooth and shiny. It is shaped like an egg and is about the size of my fist. The mass of my rock is 10 grams. It is 6.5 cm long and 4 cm wide.

Instructional Procedures

Make Rock Journal Entries

1. Have students compile their data in a journal entry. (See suggested format in sketch.)
2. Have the students write a prediction of how their rock will change. Go so far as to guess the mass, volume and length measurements.
3. After a week's period of time, open the rock tumbler, dump it into a colander and separate the rocks from the grit and water. Save the grit and water. Without adding more water to the gritty water, rinse and dry the rocks.
4. Have the students select their rock using their journal entry. There may be some disputation regarding true ownership of a rock. This would be a good time to have a discussion on the importance specific and accurate scientific explanations.
5. Have the students describe the changes that have taken place in their rock.
6. Have the students again describe the visual characteristics, length, mass, and volume measurements for their rock.

7. If there hasn't been substantial change, place the grit and dirty water back into the rock tumbler and return the rocks to the tumbler.
8. Repeat the rock tumbling again for another week and repeat steps 1-6 above. Remember to not dispose of the grit by rinsing it down a sink drain.

   It is import to discuss the observations that the students make. Here are some questions that could be used as part of the discussion:

   - How has your rock changed? Is this what your predicted?
   - Did something happen that surprised you?
   - Why do you think the tumbler water changed color?

Assessment Suggestions

- Teacher observation of activity and discussion.
- Journal Entry using a rubric you and your students have made or the one supplied.

Curriculum Extensions/Adaptations/ Integration

- Tumble a batch of rocks (all of the same relative hardness) and compare how different rocks resist weathering.
- Tumble a batch of jasper or agate through the entire polishing process (usually 4-6 weeks) using different grades of grit and polish.
- Make a line graph representing the data for the weathering of the rock.

Additional Resources

Books

How to Tumble Polish Gemstone, by Jerom Wexler; ISBN 0-9351-8237-3

Geology Crafts For Kids: 50 Nifty Projects to Explore the Marvels of Plane Earth, by Alan Anderson, Gwen Diehn, & Terry Krautwurst; ISBN 0-8069-8157-1

Exploring Earth's Treasures (Eyes on Adventure), by Donald Olson; ISBN 1-5615-6481-8

Media

Earth Science Collection. Weathering & Erosion. by 100% Education Videos, Inc. (1-800-483-3383, http://pioneer.uen.org/k12/) After logging into Pioneer, select eMedia from the general references list, and search by title.

Articles

"Take a Tumble," ***Science Scope***, (March 2006), National Science Teachers Association; ISSN 0887-2376

Web sites

http://geology.com/rock-tumbler/

http://www.geography4kids.com/files/land_weathering.html

Organizations

American Federation of Mineralogical Societies, AFMS Cental Office, P.O. Box 302, Glyndon, MD 21071-0302, (410) 833-7926, http://www.amfed.org/ , central_office@amfed.org

Rocky Mountain Federation of Mineralogical Societies, http://www.amfed.org/, webmaster@rmfms.org

Photomat

Place Rock Here	Place Rock Here
Name _____ Date _____ Mass _____ Length _____ Width _____	Name _____ Date _____ Mass _____ Length _____ Width _____
Place Rock Here	Place Rock Here
Name _____ Date _____ Mass _____ Length _____ Width _____	Name _____ Date _____ Mass _____ Length _____ Width _____

Move it!

Standard III:

Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by the soil.

Objective 2:

Explain how the processes of weathering and erosion change and move materials that become soil.

Intended Learning Outcomes:

1. Observe simple objects and patterns and report their observations
2. Compare things and events.
3. Conduct a simple investigation when given directions

Content Connections:

Social Studies VI-1; Identify physical features of Utah

Science Standard III

Objective 2

Connections

Background Information

When water, wind and ice move rock, soil or another material it is called erosion. Erosion is the mover and weathering is the breaker. Helping students understand the differences between erosion and weathering is important.

The three simplest causes of erosion are wind, water, and glaciers. Wind carries away loose bits of soil and rock, particularly in dry areas with no plants to cover and protect the land. Water can erode in several different ways. Flowing water carries soil and rock particles down streams, rivers and into lakes and oceans. Ocean waves pounding the shore and ocean currents can also carry particles away. Finally, glaciers, massive slow moving rivers of ice, gouge the land beneath them and scrape away particles and rocks away.

The scientific investigations in this activity will demonstrate three different types of erosion. They can either be presented as individual whole class investigations or as centers with small rotating groups. Four plastic boxes will be used: the stream and wave box will demonstrate water erosion, and the wind and glacier boxes will represent their respective types of erosion.

The following activities will allow the students to simulate the four types of erosion listed above. Students will follow the directions on task cards at each station and record their observations in their student journals.

Materials

- ❑ Toy dump truck
- ❑ Toy hammer
- ❑ Hard hats
- ❑ Cookies
- ❑ *What Happens to Rock*
- ❑ Plastic boxes
- ❑ Block of wood
- ❑ Water
- ❑ Play sand
- ❑ Flexi-straws
- ❑ Cornstarch
- ❑ Small pebbles
- ❑ Overhead grid
- ❑ Cotton twine
- ❑ Diatomaceous earth
- ❑ Condiment bottle
- ❑ Sprayer bottle
- ❑ Washers
- ❑ Nut
- ❑ Student journals
- ❑ Goggles
- ❑ Lab Cards
- ❑ Clothes hanger
- ❑ Overhead marker
- ❑ Bowl scraper
- ❑ Pipettes

Research Basis

Chesbro, R., (2006). Using Interactive Science Notebooks for Inquiry-Based Science. *Science Scope*. 29(3) 30-34.

The interactive science notebook is an opportunity for students to create and use a notebook that represents their science learning throughout the year. Interactive science notebooks enhance learning by encouraging students to write across the curriculum and promote personal connections to learning.

Klentschy, M., (2005). Science Notebook Essentials. *Science & Children*.

This article focuses on the effective components of student science notebooks and their use as an effective teaching tool to assist students in developing a deeper *understanding of science content*.

Invitation to Learn

Two volunteers will act out a skit that illustrates the differences between weathering and erosion. Each actor will wear a hard hat labeled with "Weathering" or "Erosion." Different types of cookies representing the different types of rocks—sandwich cookies to represent sedimentary rocks, gingersnaps to represent metamorphic rocks and chocolate chip cookies to represent igneous rocks—will be used to illustrate how the rocks are broken up and transported away. A toy dump truck will represent erosion and a toy hammer will represent weathering. Write the analogy "Weathering is to a hammer as erosion is to a dump truck."

Read to the students from the book *What Happens to Rock*. Emphasize throughout the reading that weathering is the breaking action of rocks and erosion is the moving action of the particles.

Instructional Procedures

Prepare Erosion Boxes

- **Wave Box –** Place 4 cups of play sand at one end of a plastic box. Prop up that end of the box approximately 2 to 3 cm with a book or some other stable object. Use a piece of wood 26cm x 13cm x 1cm and place it at the opposite end of the box from the sand. Pour water into the box until it touches the sand (see diagram). Reproduce lab card.
- **Stream Box –** Prop up one end of a plastic box approximately 4-5 cm with a stable object. Carefully pour diatomaceous earth into the box. (Diatomaceous earth is a fine-grained powder that

is used in swimming pool filters. Even though it may look soft like flour, it is actually very abrasive and eye protection should be used when in close contact with it.) Thread the cotton string through the nozzle of the condiment lid and tie the nut to the string so the nut will be inside of the bottle if the lid is attached. Next tie the washer to the other end of the string. Using a bent hanger, suspend the condiment bottle over the high end of the inclined box so the string end with the washer touches the bottom of the box and is covered by the diatomaceous earth. Use the sprayer bottle and wet down the diatomaceous earth until it is damp. Fill the condiment squirt bottle with water and replace the lid. Place it in the hanger support and let the water drizzle down the string and into the diatomaceous earth. Continue adding water to the condiment bottle as needed.

Wave Box

- **Glacier Box –** Duplicate the centimeter grid onto an overhead transparency and tape it to the outside bottom of the box. Pour the 16-oz box of cornstarch into a container and add water slowly until it is the consistency of toothpaste. Be careful that the mixture is not too runny. Raise one end of the box between 2 to 4 cm. Have bowl scraper and glass pebbles on hand for the students.
- **Wind Box –** Place the rocks inside the last plastic box. Pour sand over the top of the rocks so they are completely covered (there should be 3-4 inches of sand in the box. Have the bendy straws available for student use.

Stream Box

Erosion stations

Group the students so that 3 to 4 of them will be at a station at a time. Explain that they will need to follow the Investigation Procedure listed on the card and then discuss with their small group the Investigation Questions on the opposite side of the card. Have them complete the required questions, and if time permits, the optional questions.

Assessment Suggestions

- Teacher observation of activity and discussion.
- Journal Entry using a rubric you and your students have made or the *Take a Tumble Journal Rubric*.

Curriculum Extensions/Adaptations/ Integration

- If more small groups are needed, you can use the "Rock Stars" and "Earth Mover" articles listed in the additional resources. These readings can offer a non-hands-on inquiry opportunity.

Additional Resources

Books

Sand, by Ellen J. Prager; ISBN 0-7922-7104-1

Kids Discover: Glaciers, by Stella Sands; ISSN 1054-2868

What Happens to Rock big book by Fred & Jeanne Biddulph; ISBN 0-7802-2794-8

Articles

"Rock Stars", by Beth Geiger. *National Geographic Explorer*, National Geographic Society; Vol 7, No. 5, March 2008; pp. 10-17; ISSN 1541-3357

"Earth Movers", by Lesley J. MacDonald. *National Geographic Explorer,* National Geographic Society; Vol 6, No. 2, Oct 2006, pp. 18-23; ISSN 1541-3357

Web sites

http://magma.nationalgeographic.com/ngexplorer/0501/quickflicks/

http://topsoil.nserl.purdue.edu/nserlweb/weppmain/overview/ersn.html

http://www.newtonsapple.tv/TeacherGuide.php?id=1657

https://imrcms.nps.gov/brca/forteachers/earthsystemactivity12.htm

http://3dparks.wr.usgs.gov/

Organizations

Minerals Management Service, 1849 C Street, NW Washington, D.C. 20240, http://www.mms.gov/mmshome.htm , gary.strasburg@mms.gov

Wave Box Investigation Procedure

Description: For this investigation you will be simulating erosion caused by waves. Carefully drain the water from the box. Use the bowl scraper to move the sand to one end of the box. Place the two rocks somehwere on the sand. Raise one level of the box between 2-4 cm. Put the piece of wood in the box and pour in enough water to reach the sand.

Predictions: Make a written predictions in your journal about what you think you will observe and what you think will happen.

Procedure

1. Tilt the box and use the bowl scraper to move the sand to one end of the box.
2. Raise one end of the box the box between 2-4 cm and place it on a stable support.
3. Insert the board in the box and add enough water so that it touches the sand
4. Have a member of the group keep track of time.
5. Have a member of you group simulate waves by tipping the board at regular smooth movements.
6. Observe what happens as the waves wash across the sand.
7. Follow the discussion guidelines on the other side of this card.

Stream Box Investigation Procedure

Description: For this investigation you will be simulating a stream using diatomaceous earth. Diatomaceous earth can cause eye irritation, so each make sure to wear goggles and avoid touching the white powder.

Predictions: Make written predictions in your journal about what you think you will observe as to what will happen.

Procedure

1. Put on goggles.
2. Make sure the condiment bottle is filled with water. If you need to fill the bottle, unscrew the lid and leave it at the box, fille the bottle and screw the lid back on.
3. Place the bottle into the holder.
4. Observe what happens as the water dribbles down the string.
5. Have a member of the group keep track of time.
6. Observe what happens to the simulated stream after 5 minutes.
8. Follow the discussion guidelines on the other side of this card.

Wave Box Investigation Questions

Discussion: Discuss with your group members what you observed. Respond to the following questions:

- Did the simulation do what you had expected?
- Was there something unexpected that happened?
- Could you make some generalizations about the movement of the different sand particles?

Journal Entry: Choose one of the questions above and respond to it in writing in your journal. Make a sketch or graph of what you observed.

Extension: If you have time choose one or more of the following tasks:

- If you were to do this investigation again, what would you change or do differently?
- Did the profile of the sand take a specific shape.

Stream Box Investigation Questions

Stream Box Investigation Questions Discussion: Discuss with your group members what you observed. Respond to the following questions:

- Did the simulation do what you had expected?
- Was there something unexpected that happened?
- Could you make some generalizations about the stream shape?

Journal Entry: Choose one of the questions above and respond to it in writing in your journal. Make a sketch or graph of what you observed.

Extension: If you have time choose one or more of the following tasks:

- If you were to do this investigation again, what would you change or do differently?

Glacier Box Investigation Procedure

Description: For this investigation you will be using a mixture of cornstarch and water. This mixture has some interesting properties that will allow us to simulate an actual glacier. Glaciers, though slow moving, can move large quantities of rock material; some very small and others very large. It is OK to touch the cornstarch mixture, but be sure to let it flow naturally.

Predictions: Make written predictions in your journal about what you think you will observe and what you think will happen.

Procedure:

1. Tilt the box and use the bowl scraper to move the cornstarch mixture to one end of the box.
2. Lay the box flat and place the colored stones at different places on the box near the cornstarch.
3. Have one of the members of your group carefully pick up the box while another member of your group uses the overhead marker to draw a circle for each location of the colored rocks on the overhead transparency taped to the bottom of the box.
4. Raise one end of the box the box between 2-4 cm and place it on a stable support.
5. Have a member of the group keep track of time.
6. Observe what happens to the simulated glacier.
7. After 5 minutes, pick up the box and mark the ending location of the colored rocks.
8. Remove the overhead transparency.
9. Follow the discussion guidelines on the other side of this card.

Wind Box Investigation Procedure

Description: For this investigation you will be simulating wind erosion. You will use a bendy drinking straw, but instead of sucking through the straw you will blow through it. In addition, you wont be putting your mouth near the bendy end of the straw. You will place your mouth at the end furthest from the bendy part. This will let you simulate wind blowing across the sand rather than down on it.

Predictions: Make written predictions in your journal about what you think you will observe about what you think will happen.

Procedure:

1. Put on goggles.
2. Have a member of the group keep track of time.
3. Blow across the sand with your straw.
4. Observe what happens.
5. Stop after 5 minutes.
6. Throw away your straw so someone else won't use it.
7. Follow the discussion guidelines on the other side of this card.

Glacier Box Investigation Questions

Discussion: Discuss with your group members what you observed. Respond to the following questions:

- Did the simulation do what you had expected?
- Was there something unexpected that happened?
- Did all the colored stones move at the same rate?
- Could you make some generalizations about the movement of the colored rocks?

Journal Entry: Choose one of the questions above and respond to it in writing in your journal. Make a sketch or graph of what you had observed.

Extension: If you have time, choose one or more of the following tasks:

- If you were to do this investigation again, what would you change or do differently?
- Could you calculate the rate at which the rock moved? Were there some rocks that moved faster than others? Why do you think this happened?

Wind Box Investigation Questions

Discussion: Discuss with your group members what you observed. Respond to the following questions:

- Did the simulation do what you had expected?
- Was there something unexpected that happened?
- Did all the colored stones move at the same rate?
- Could you make some generalizations about movement of the sand?

Journal Entry: Choose one of the questions above and respond to it in writing in your journal. Make a sketch or graph of what you observed.

Extension: If you have time choose one or more of the following tasks:

- If you were to do this investigation again, what would you change or do differently?
- Could you calculate the rate at which the rock moved? Were there some rocks that moved faster than others? Why do you think this happened?

Name _____ Date _____

Take a Tumble Journal Rubric

	4	3	2	1
Measurements	Includes mass, width, length, and volume measurements.	Is missing one measurement.	Is missing two measurements	Is missing more than two measurements.
Visual Description	Includes specific visual characteristics of shape, color, and identifying marks. Uses complete sentences.	Includes specific visual characteristics of two of the three categories. Most sentences are complete.	Includes general visual characteristics of two or more categories. Some sentences are complete.	Includes visual description of one characteristic. Most sentences are fragments.
Predictions/ Observations	Includes a specific prediction of how the rock will change, and a specific observation of the actual changes.	One prediction/ observation is specific. The other is general.	Both the prediction of change and the observation of change is general.	Includes either a prediction or an observation of change but not both.

Math II-2

Activities

Order of Operations

Socks and Shoes

Standard II:

Students will use patterns and relations to represent mathematical problems and number relationships.

Objective 2:

Use algebraic expressions, symbols, and properties of the operations to represent, simplify, and solve mathematical equations and inequalities.

Intended Learning Outcomes:

2. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notations of mathematics.

Content Connections:

Language Arts IV-1; Communicating, listening, & speaking
Language Arts IV-8; Communicate effectively for a variety of purposes

Math Standard II

Objective 2

Connections

Background Information

Before beginning this lesson, teachers must have a sound understanding of why the process of order of operations is important in math and how to correctly perform it. Order of operations is important in math because it helps assure us that math works the same way for everyone, regardless if they are students in Utah or professors in Japan. Through this understanding; we can safely say that an addition or multiplication problem solved correctly will always result in the same answer. As educators we need to help our students understand that they will always get the right answer if they follow the process correctly.

A common misconception is that multiplication must be performed before division. When we use the mnemonic Please Excuse My Dear Aunt Sally, it is often assumed that because we say My (multiplication) before Dear (division) that we need to multiply first. However, multiplication and division are on the same level and should be performed based on their position in the order of operations problem. This same principle applies with addition and subtraction. The correct order of operations starts with working in parentheses, then looking for exponents, and then returning to the left or beginning of the equation and working your way towards the right as you solve. Once you have performed the multiplication or division steps, you return the beginning of the problem and work your way left to right, performing

addition or subtraction in the proper order. This will allow you to answer the problem correctly.

For these activities, we are going to focus on order of operations problems that deal with addition, subtraction, multiplication, and division. Students need to be familiar with basic multiplication and division facts and need to be taught about parentheses. Exponents are not found in the Utah State Math core until the 5th grade and so we are not going to be working with problems that have exponents in them.

Research Basis

Millis, B.J. (2002). Enhancing learning-and more! through cooperative learning. Idea Paper # 38. The Idea Center, 211 South Seth Child Road Manhattan.

In this article, Millis explains the power and effectiveness of cooperative learning. Not only is cooperative learning an effective teaching strategy, it "promotes a shared sense of community" in the classroom because "learning, like living, is inherently social." As students learn to work together through cooperative learning, they develop trust with each other and are given an opportunity to develop self-efficacy. As teachers come to understand how to implement cooperative learning, "student learning can be deepened, students will enjoy attending classes, and they will come to respect and value the contributions of their fellow classmates."

Willis, J. (2007). Cooperative learning is a brain turn-on. *Middle School Journal*. March pgs. 4-13

Judy Willis states in her article that research has shown that "in math collaboration, students learn to test one another's conjectures and identify valid or invalid solutions." This happens because cooperative learning provides students with the most opportunities to ask questions, express ideas and opinions, and come to conclusions that they might not otherwise have through whole group instruction. Teachers can increase student understanding and involvement by increasing the amount of cooperative learning in their classrooms.

Invitation to Learn

The most commonly used mnemonic for order of operations is Please Excuse My Dear Aunt Sally. Instead of teaching this mnemonic to the class, the purpose of this invitation to learn is to help students develop ownership for their learning as they work together to develop a unique classroom mnemonic of their own liking.

The first step in this process is to say, "Today we are going to create a mnemonic that is going to help us as we learn about order

Materials

- ❑ Math Journals
- ❑ Pencils

of operations. Does anyone know what a mnemonic is? A mnemonic is a phrase or saying that makes information easier to remember. Has anyone ever heard of "righty-tighty, lefty-loosey"? How about "Every Good Boy Does Fine"? These are mnemonics that help us remember how to tighten or loosen a bolt and the order of musical notes on a treble staff. Using these mnemonics makes it easier to remember these things."

Go to the board and write order of operations at the top of the board. Explain that there are five steps in solving order of operation problems. (Don't worry about explaining the steps in detail. We will do that in greater detail later.) As you introduce the steps, write the steps on the board. The steps are Parentheses, Multiplication, Division, Addition, and Subtraction. Remember that our students are not going to be using exponents in 4th grade and so we do not need to include exponents in our mnemonic.

Next say, "Now we need to come up with a mnemonic phrase that will help us remember the steps when solving order of operations problems. Do you remember what a mnemonic phrase is? It is a phrase or saying that helps us remember. The most common mnemonic for order of operations is Pardon My Dear Aunt Sally (The mnemonic changes when the E for exponents is taken out), but that's no fun. Let's come up with a fun mnemonic. For example, we could say "Pink Monkeys Dance Around Santa" or "Pretty Muffins Dream About Snickerdoodles."

The next step can be done either as a whole class process or as a think-pair-share activity. We will focus on the think-pair-share activity because it gives every student an opportunity to participate. Begin by saying, "We are going to do this by doing a think-pair-share. First, you are going to use your math journals and write down a fun mnemonic phrase. Then, you are going to share your mnemonic phrase with your neighbor."

While the students are thinking and sharing, go around the room and put the class into groups of six. Then say, "Now that you have had a chance to share with your neighbor, you are going to get into your groups and share again. When you have all had a chance to share, you need to pick one mnemonic phrase from your group that you feel would be the most successful as our class saying."

When the students have decided, have each group share the mnemonic phrase. Write each mnemonic on the board and then have the class vote on which mnemonic phrase they would like to use. Once the mnemonic phrase is decided, have the students write down the phrase in their math journals.

Instructional Procedures

Socks and Shoes

Materials

- ❑ Socks
- ❑ Shoes
- ❑ Math journals
- ❑ Pencils

The purpose of this activity is to bring students' background knowledge into the lesson and to allow them to see how order of operation applies to nearly everything they do during the day.

1. Divide the class into 4-6 groups. Students need to bring their math journals and a pencil to their group. You are going to need 1 sock and 1 shoe for every group. For health reasons do not use student socks or shoes.
2. Begin by saying, "I am going to be passing out two objects to every group. Before you do anything with these two objects, I want each group to discuss how these two objects relate to each other." Pass out 1 sock and 1 shoe to each group. Give them 2 or 3 minutes to discuss how a sock and shoe relate to each other.
3. Once you have done this, have each group share their ideas with the rest of the class.
4. Say, "Now that we have talked about how a sock and shoe relate to each other, I want you discuss the correct way of putting on a sock and shoe. Come up with a series of steps that you need to follow to do it correctly. When you think you have the correct way, write the steps down in your math journals. Be ready to share your ideas." Give the students 5 minutes to write down their steps.
5. When they are done, have each group share their steps. Compare the order of steps from each group and come up with a class list of the proper and correct manner of putting on your socks and shoes.
6. Now ask, "Why is important that you have steps as you put on your socks and shoes? What would happen if you didn't follow the steps correctly?" Call on some students to share their ideas, and then say, "Now for some fun. I am going to give every group 5 minutes to come up with as many creative ways to use your sock and shoe without using them correct way or following the steps. Write down your ideas in your math journal. Remember, have some fun and be creative." Don't be afraid of silly or goofy answers because this is what you are looking for.

7. As your students finish their lists, say, "I need you to choose your top three ways that your group thinks no one else has thought of, and label them 1, 2, and 3." Let them choose.
8. Say, "Now that you have come up with your top three ways, we are going to make a class list." As each group shares, write their answers on the board. Make sure that the students share their fun answers.
9. Once you have the list on the board, ask the class, "What do you notice about the ideas on the board?" Guide the students in their answers and help them understand that even though the ideas on the board might be funny, they are all wrong and that if we don't use socks and shoes properly, they "don't do what they are supposed to."
10. Then ask the class, "What other things do you do throughout the day that need to be done in a certain order?" Possible answers could range from brushing your teeth, getting dressed, eating breakfast or lunch, to even doing homework. Discuss what could happen if you stopped doing those things in the right order. Help the students understand that order is very important in everything that they do.
11. End this activity by saying, "Now that we have talked about order of operations and why we need to do things in order, you are going to write an entry in your math journal about why order of operations is important to you." If you want, you can have the students label their math journal entry "Why Order of Operations is Important to Me" or you can have them write their own title. Have the students turn in their journal when they are done to check for understanding.

Assessment Suggestions

- Use the students' journals to assess their journal entry on "Why Order of Operations is Important to Me".
- Listen and monitor group discussion on order of operations.
- Make sure that students don't start wearing socks over their shoes.

Curriculum Extensions/Adaptations/ Integration

- Advanced learners may design a science experiment that needs to follow a certain order of steps. They could demonstrate

the results of doing it incorrectly (not following the steps in order) and then show what happens when the correct steps are followed.

- This activity may be adapted by having students act out or model the proper way of doing things instead of writing the steps down.
- This activity can be integrated into writing by having students write a story about what the world would look like if things were done out of order.
- Teachers may use previously learned math concepts to demonstrate wheat happens when math problems are done out of order.

Family Connections

- Students can discuss order of operations with their parents.
- Students can come up with a list of activities that they do everyday as a family that are done in a certain order. Then they can come up with ideas of what would happen if the family started doing things differently.

Additional Resources

Web sites

http://www.mathgoodies.com/lessons/vol7/order_operations.html

http://www.dositey.com/math/m/mystery2SMA.htm Solve the equations to reveal the picture.

http://www.tki.org.nz/r/wick_ed/maths/interactives_matho2.php Online game called Matho.

http://cemc2.math.uwaterloo.ca/mathfrog/english/kidz/order.shtml Timed order of operation problems.

http://www.funbrain.com/cgi-bin/alg.cgi?A1=s&A2=3 Basic order of operations practice.

Property Posters

Standard II:

Students will use patterns and relations to represent mathematical problems and number relationships.

Objective 2:

Use algebraic expressions, symbols, and properties of the operations to represent, simplify, and solve mathematical equations and inequalities.

Intended Learning Outcomes:

2. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notations of mathematics.

Content Connections:

Language Arts IV-1; Communicating, listening, & speaking
Language Arts IV-8; Communicate effectively for a variety of purposes

Math Standard II

Objective 2

Connections

Background Information

The most important background information for this activity is that teachers need to be familiar with the commutative and associative properties of addition and multiplication. They also need to be familiar with the zero and identity properties of multiplication and know how to teach these properties to their students.

The associative property teaches us that two numbers added or multiplied together can be added or multiplied in either order and that they will come up with the same answer. For example, we see that 3 + 6 = 6 + 3 and 3 x 6 = 6 x 3. The commutative property teaches us the same thing but deals with 3 or more numbers. For example, we can see that 3 + 6 + 2 = 2 + 3 + 6 and 3 x 6 x 2 = 2 x 3 x 6. The identity property teaches us that any number multiplied by 1 will always equal that same number. Finally, the zero property of multiplication teaches us that any number multiplied by 0 will always equal 0.

Research Basis

Millis, B.J. (2002). Enhancing learning-and more! through cooperative learning. Idea Paper # 38. The Idea Center, 211 South Seth Child Road Manhattan.

In this article, Millis explains the power and effectiveness of cooperative learning. Not only is cooperative learning an effective teaching strategy, it "promotes a shared sense of community" in the classroom because "learning, like living, is inherently social." As

students learn to work together through cooperative learning, they develop trust with each other and are given an opportunity to develop self-efficacy. As teachers come to understand how to implement cooperative learning, "student learning can be deepened, students will enjoy attending classes, and they will come to respect and value the contributions of their fellow classmates."

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Judy Willis states in her article that research has shown that "in math collaboration, students learn to test one another's conjectures and identify valid or invalid solutions." This happens because cooperative learning provides students with the most opportunities to ask questions, express ideas and opinions, and come to conclusions that they might not otherwise have through whole group instruction. Teachers can increase student understanding and involvement by increasing the amount of cooperative learning in their classrooms.

Invitation to Learn

Materials

- ❑ Examples of different types of posters (movie, educational, motivational, sport, or quick reference)
- ❑ Math journals

The purpose of this invitation to learn is to help students understand that posters are used for a variety of reasons, many of which focus on advertising, communication, and information. Before beginning this activity, place a variety of posters around the room. Most classrooms already have posters hanging in them but for this activity try and hang some new or different posters that are new to the students.

Begin by saying, "As you may have noticed, I have hung some different posters around the room. I want you to take a few minutes, wander around the room, and look at the posters. As you wander, I want you think about the questions I am going to write on the board." Write the following questions on the board: Why do we have posters (what do posters do)? Are there different types of posters? Which ones do you like the best?

Then say, "The questions I want you to think about are: Why do we have posters (what do posters do)? Are there different types of posters? And which ones do you like the best? After you have wandered around the room, I want you to take a minute or two and write down your thoughts in your math journals." Give the students two or three minutes to look at the posters before sending them back to their desks to write in their journals.

After the students have written in their math journals, start with question one and say, "Let's talk about why we have posters. Does anyone have any ideas about why we have posters?" Let the students

share their ideas. Help them come to the understanding that posters are used to advertise things, communicate ideas, entertain, and share information.

Then ask, "How many of you think that there are different types of posters? Do we have different types of posters in our classroom?" Call on different students to point at different posters throughout the room. As you point them out, compare different posters, finding similarities and differences.

End this invitation to learn by discussing the third question. Say, "So, which posters did you like the best?" As you call on students to share, follow up this question with the famous "Why?" It is important that students explain why they like the posters. This will help them as they design their own posters in the next activity.

Instructional Procedures

Materials

- ❑ Poster Paper
- ❑ Crayons
- ❑ Math Journals

This activity is going to focus on helping students remember the commutative, associative, distributive, and identity properties of addition and multiplication by having the students create posters that they will hang around the school or classroom. However, this activity is not going to focus on teaching the properties. If the students haven't written these properties down in their math journals yet, have them write them down as you review.

1. Begin this activity by dividing your class into groups of 4-6 students. Start by saying, "Today we are going to be reviewing the properties of addition and multiplication. When we are done, we are going to make posters that we can place around the room or school to help us remember them."
2. Go to the board and write Properties of Addition and Multiplication. Say, "There are four properties that we are going to include on our posters. I am going to model and review the properties first, and then you will get into your groups and design a poster that demonstrates each property."
3. Next say, "We are going to start with the commutative property. The Commutative property teaches us that when we add or multiply two numbers, we can add or multiply them in any order."
4. Write 2 + 4 and 2 x 4 on the board. Start with 2 + 4 and say, "Let's look at 2 + 4. When we add 2 and 4 together, what do we get? 6." Now ask, "What happens when I switch the 4 and 2 and write 4 + 2? What answer do we get? Do we get the same answer? Yes, we do. Now I want you to take a few seconds

in your group and discuss why we get the same answer. Get ready to share your answers." Give the students some time to discuss. Have them share their answers when they are done. As the students share their answers, emphasize the fact that it doesn't matter what order you add because you will get the same answer.

5. Repeat this same process using 2 x 4 to review for multiplication.
6. Then say, "The next property we are going to review is the associative property. The associative property is similar to the commutative property except it uses three or more numbers." Write 2 + 4 + 3 and 2 x 4 x 3 on the board and then say, "Let's start with 2 + 4 + 3. We can use parentheses to help us add when we have more numbers." Place parentheses around the 2 + 4 so that it looks like (2 + 4) + 3. Most problems already have the parentheses around them when they have three or more numbers but it is important to help students understand that they can use parentheses to help them out.
7. Say, "Remember, when using order of operations we always do what is in parentheses first. What two numbers are in the parentheses? 2 + 4. Let's add those together. What do we get? 6. Good." Write the 6 below (2 + 4). Then say, "Now that we have added 2 and 4, we need to add 3 to our answer. Let's add 6 + 3. What do we get? 9."
8. Now say, "Let's try this problem again, but this time we'll move the parentheses and place them around the 4 and 3." Place parentheses around the 4 + 3 so that the problem now looks like 2 + (4 + 3). Ask the class, "What's the rule about parentheses? Good, we need to do the problem in the parentheses first. Let's add 4 + 3. What answer do we get? 7." Write the 7 below the (4 + 3).
9. Now ask the class, "What do we do now?" Wait for the appropriate answer and then say, "That's right, we need to add 2 + 7. What do we get? 9. Did we get the same answer? We did, didn't we? Just like the Commutative property, the Associative property teaches us that it doesn't matter the order in which we add three or more numbers because we will get the same answer."
10. Repeat this same exercise with 2 x 4 x 3 to review the associative property for multiplication.

11. Next say, "Now that we have discussed the associative and commutative properties, we have two more properties that we need to talk about. These are the Identity and Zero properties of multiplication." Write 6 x 1 = ? on the board and ask, "What do we get when we multiply 6 x 1?" Wait for the students to answer. Do this a few more times with different numbers multiplied by 1. When you have done this, ask the class, "What do you notice about these problems?" Lead the discussion towards the fact that any number multiplied by 1 will equal that same number. End by saying, "This is what the Identity property teaches us. Any number multiplied by 1 equals that same number."
12. "Let's finish our review by talking about the Zero property of multiplication." Write 6 x 0 = ? on the board and then ask, "Does anyone know what happens when we multiply 6 by 0? What answer do we get? Zero, that's right. What would happen if I multiplied 1,000 by 0? What answer would we get? Zero again. What about 1,000,000 x 0? Do we get zero again? We do. This is what the Zero property of multiplication teaches us. Any number multiplied by zero, no matter how big or small, will always equal zero."
13. Now say, "Now that we have reviewed the properties of addition and multiplication, I am going to pass out a piece of poster board and markers (crayons or colored pencils) to each group. On your poster, you are going to define and give examples of each property. You can decorate the poster however you like, but make sure that it is your best penmanship and artwork. You can also use your math books and math journals to help you define the properties. If you are not sure about the wording of your definition, raise your hand for clarification."
14. Pass out the poster paper, and markers (crayons or colored pencils), and allow the students to work on their posters. As students work, it is important that the teacher monitors the definitions that the students are writing.
15. When students are finished with their posters, allow them to present the posters to the class and then let them decide where they would like to hang them.

Assessment Suggestions

- Use the student posters to assess student understanding of addition and multiplication properties.

- Students may develop their own property problems.
- Students can conduct a survey of other classes to see if the posters helped them remember the properties.

Curriculum Extensions/Adaptations/ Integration

- Advanced learners may study the history of posters and then write a paper explaining what they found.
- Learners with special needs may work cooperatively with regular education students.
- Instead of creating posters, students may develop an alternative media source (TV commercials, postcards, radio ads) that explain the properties.
- The associative, commutative, identity, and zero properties can be used as spelling words.

Family Connections

- Students may create their own posters for their rooms or homes.
- Students may create a "family" poster to share with the class.

Order of Operations Treasure Hunt

Standard II:

Students will use patterns and relations to represent mathematical problems and number relationships.

Objective 2:

Use algebraic expressions, symbols, and properties of the operations to represent, simplify, and solve mathematical equations and inequalities.

Intended Learning Outcomes:

2. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notations of mathematics.

Content Connections:

Language Arts IV-1; Communicating, listening, & speaking
Language Arts IV-8; Communicate effectively for a variety of purposes

Math Standard II

Objective 2

Connections

Background Information

The purpose of this activity is to give students the opportunity to use order of operations equations in a fun, engaging environment. During this activity, students will have the opportunity to work collaboratively as they create a treasure map and clues that are based on order of operation equations of their own design. Due to the nature of this activity, you may want to have some parents or other volunteers assist you. This activity may be done in one day or it may be broken up over a few days, whatever is most efficient for the teacher.

Before teaching this lesson, students must be familiar with the correct order of steps when performing order of operation problems. For these activities, we are going to focus on creating order of operations problems that deal with addition, subtraction, multiplication, and division. Students need to be familiar with basic multiplication and division facts and need to be taught how to use parentheses in order of operations equations.

This activity is going to require students to work in a small group setting. If students haven't had many experiences working in small groups, take the time to establish expectations about proper behavior. Many teachers like to assign group responsibilities such as group leader, scribe, material manager, and so forth when working in small groups. In this activity, the students are going to have the roles of *Map Maker, Interpreter, Guide, and Captain*. The *Map Maker* will be responsible for drawing the treasure map, the *Interpreter* will write

down the clues, the *Guide* will be responsible for getting materials, and the *Captain* will be responsible for keeping the group on task. This will give each student the opportunity to actively participate in the group.

As I tried this activity in my classroom, I found that students wanted to use a lot of numbers for each problem. The students need to start with simple problems that deal with addition or subtraction and then work their way towards more difficult problems that include parentheses, multiplication, and division. I would limit the amount of numbers for each problem to less than 6 numbers for the more difficult problems.

Research Basis

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Invitation to Learn

Materials

- ❑ Math Journals

This invitation to learn is simple. Ask the students what they would do if they found hidden treasure. What would they buy, where would they go, or who would they help? Have them write their answers in their math journals. Discuss their answers as a class.

Instructional Procedures

1. Before starting this activity, draw a simple map of your room on the board. Label important features such as the door, windows, teacher's desk, and whiteboards. Then hide something in your room (it could be anything) and come up with a series of clues or steps that the students need to follow in order to find the object. These clues should focus on students doing things a certain number of times, such as "take 4 steps towards the front of the room" or "spin around 2 times and face the windows." Write the clues on the board next to the map but instead of writing "Take 5 paces north" write "Take (4 x 3) + 2 – 9 paces north". For your first three clues, come up with order of operations problems that tell how many times the students need to do something. On the rest of your clues, leave a blank space where the order of operations should go. The class will work in groups of 4 to create their own order of operation problems that equal the number in each clue.
2. Begin this activity by placing the treasure chest in front of the class. Ask the students, "Does anyone know what this is?" Allow the students to answer and then ask, "Who can tell me what a treasure box is?" or "What do you find inside of a treasure chest?"
3. Continue the class discussion by asking, "Where do you find a treasure chest? Are they easy to find?" Allow the class to continue answering and then ask, if it hasn't already been brought up, "What do you usually need in order to find a treasure chest? That's right. You need a treasure map." Hold up the treasure map so that your students can see it.
4. Then ask, "Do you need anything else besides a treasure map? What kind of tools and clues would make finding the treasure chest easier?"
5. Then explain, "Today we are going to go on a quick treasure hunt. However, instead of using the treasure map in my hands, we are going to use the map I have drawn on the board." Pointing at the map and clues on the board say, "This is a map of our classroom. I have hidden "treasure" somewhere in our room and we need to use the map and clues in order to find it."
6. Divide your class into groups of 4 and assign each group member one of the following roles: Map Maker, Interpreter,

Materials

- ❏ Construction paper
- ❏ Crayons
- ❏ "Treasure"
- ❏ *Order of Operations Compass*
- ❏ Treasure Chest
- ❏ Treasure Map
- ❏ Lined paper
- ❏ Pencils
- ❏ Parents/Volunteers

Guide and Captain. Give them a few minutes to decide a team name.

7. Point at the board and say, "The treasure is hidden somewhere in our room. Let's look at our first clue to see if it can help us." Read the first clue to the class and then ask, "How is this clue different from regular clues?" Help the students understand that the order of operation problems need to be solved before we can do what the clue tells us.
8. Take this time to review the class mnemonic that you have developed and to pass out a piece of lined paper and the order of operations compass.
9. Have the students solve the order of operation problem as a group and then choose one student from the class to follow and do what the clues say to do as the class solves them.
10. Repeat this process for the next two clues.
11. For your next clue say, "Notice that the next clue does not have an order of operations problem or number listed. For the next few clues, I am going to give you the number and you are going to have to create your own order of operation problem that equals that number."
12. Start the students out with simple problems that deal with addition and subtraction. Give the students time to work on their problems and then have them trade problems with a different group.
13. Repeat this same process with the rest of your clues until the student finds your hidden "treasure". Allow the students to use multiplication and division to make the clues more difficult.
14. Once you feel that the students are capable of writing order of operation problems, they can start on their own treasure maps and clues.
15. As students are deciding where to hide their treasure, the students should choose places that are not in classrooms or in locations that will disturb other teachers or students. (If you decide to do this activity in your school, talk to your school administrator and inform him/her what is going to be happening.)
16. Say, "I am going to give you 5 minutes to decide where you would like to hide your treasure. Captains make sure that your group is back on time. Once you have decided, come back to the classroom. As you come back into the classroom, the

Guides will get two pieces of lined paper, one for your treasure map and the other for your clues."

17. When all of the students have found their spots, the next step is to develop their clues and maps. Begin this process by saying, "Now that you have found your spots, we now need to come up with clues that will lead us to the treasure. Interpreters are going to write the clues on one piece and Map Makers are going to draw a rough draft of the treasure map on the other."
18. "Your clues should be simple but fun. You can hop, skip, walk backwards, pace, and even army crawl towards the treasure. For example, as you go towards the treasure you could have a group 'Hop 5 times down the hall'."
19. "As the Interpreter is writing down your clues, the Map Maker needs to be drawing your treasure map. Make sure you label important places on the maps such as rooms, stairs, or playground equipment."
20. "Captains, you are responsible for taking care of your group. When you get done with your clues and treasure map, come back to the classroom. As you come into the classroom, Guides need to get a piece of tan construction paper to draw your map on."
21. When all of the students are back in the classroom and working on their maps, say, "Let's take a few minutes and talk about your clues. Remember that we are going to be developing order of operations problems for each clue. This will make each clue more difficult and fun to follow."
22. Then say, "Everybody look at your first clue. As a group, I want you to come up with an order of operations problem for your first clue. Remember to use your order of operation compasses and our classroom mnemonic to make sure that each problem is solved correctly. Raise your hands when you have created your first problem and I will come and check it."
23. Once you have checked the first clue say, "You are now going to create order of operation problems for each of your clues." Have the students turn their papers in when they are done.
24. Once the order of operation problems have been checked, pass them back to each group. The group will then write the clues on the back of their treasure maps.
25. When the students are finished with their maps and clues, have the group follow their own clues and map one more time. As

the students are trying it out, give the students "treasure" that they can hide.

26. The final part of this activity will be to trade the maps and clues with other groups. The students will need to have a piece of lined paper to solve the equations as they look for the treasure. The students will only get to keep the treasure if they show the other group their work and answers for each clue.
27. End this activity by having the students reflect on the following questions in their math journals. Write the following questions on the board. "What did you learn from this activity?" "What was the most difficult part of this activity?" "What was the most enjoyable part of this activity" "Did this activity help you understand order of operation problems? How?"

Assessment Suggestions

- Collect and read the students' math journals.
- As students are developing their order of operation problems, informally assess if they are doing them correctly.
- Listen to student discussion during cooperative learning.

Curriculum Extensions/Adaptations/ Integration

- Advanced learners can work with learners with special needs as student tutors.
- Order of operation clues can be made more difficult.
- This activity can be adapted to meet the needs of learners with special needs by simplifying the amount or difficulty of each clue.
- This activity can be integrated into writing as students write a fictional story about them finding a treasure map.
- Students can research the history of treasure maps.
- Find books and stories that deal with treasure maps.

Family Connections

- Students can make treasure maps of their room, yard, or home.
- Students can study maps with their parents and discuss how to read them correctly.
- Invite parents into the classroom to help with this activity.

Additional Resources

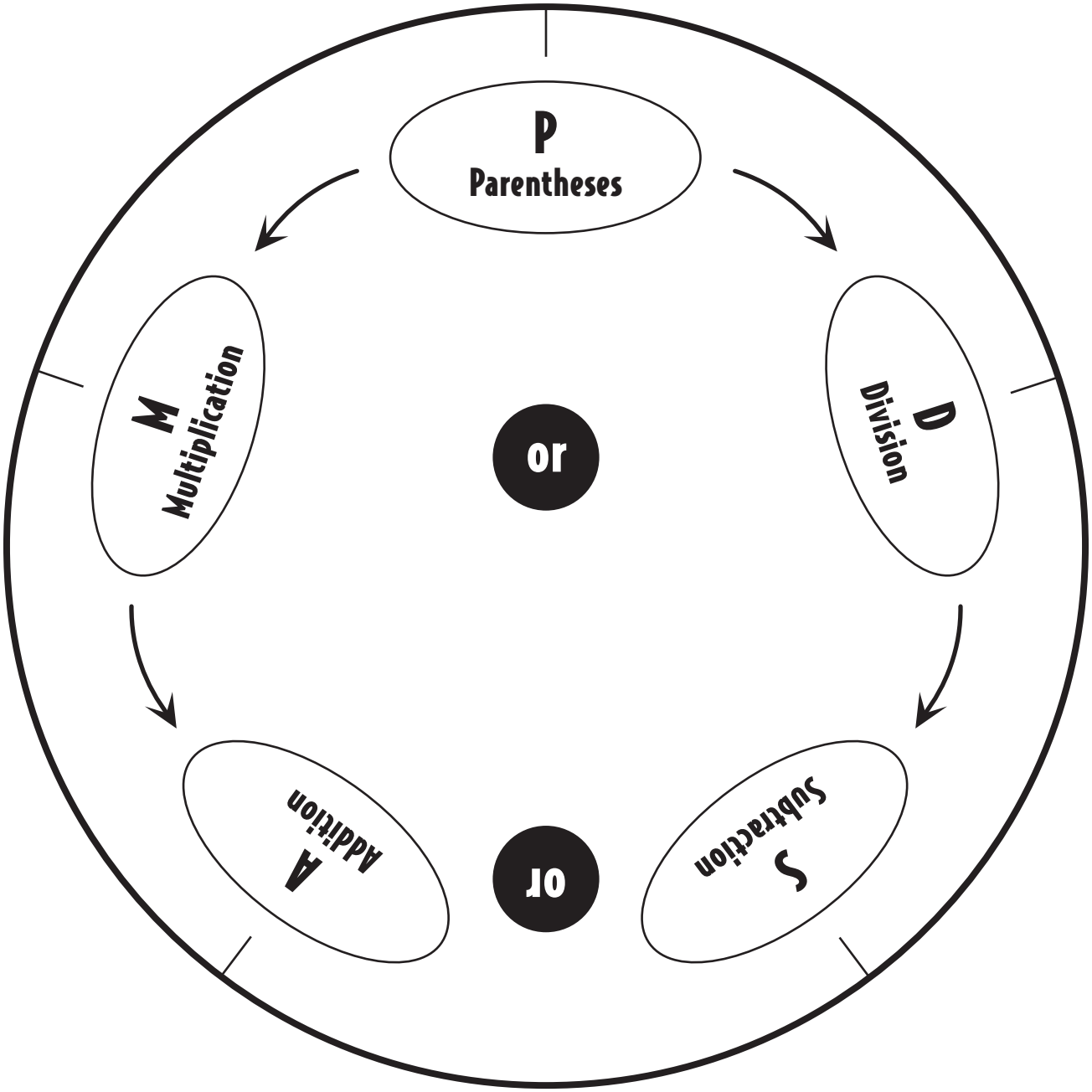
Books

Treasure Hunters- The Usborne Book of Treasure Hunting (Prospecting and Treasure Hunting), by Anna Claybourne, Caroline Young, Judy Tatchell, and Jenny Tyler; ISBN 0746034458

Treasure Map (MathStart 3), by Stuart J. Murphy; ISBN 0064467384

100 Puzzles, Clues, Maps, Tantalizing Tales, and Stories of Real Treasure, by Michael Stadther; ISBN 0976061813

Order of Operations Compass



Science V-3

Activities

Classification

Classifying Kids

Standard V:

Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 3:

Use a simple scheme to classify Utah plants and animals.

Intended Learning Outcomes:

1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests

Content Connections:

Math III-1; Identify geometric shapes

Science Standard V

Objective 3

Connections

Background Information

This activity is meant to get students excited about grouping and classifying. Students need to get up and experience classifying to help them understand better how to use a classification key. This activity can be done with or without prior knowledge of sorting. It would help if students were familiar with the words *classification* and *grouping*.

Research Basis

Wolfe, P. (2001). Brain matters: translating research into classroom practice. Association for Supervision and Curriculum Development, Alexandria, VA.

The brain processes abstract information best after experiencing real things first and then symbolic representations. To analyze and compare information, the brain needs to be able to base it on an experience. When learning science, students need to be presented with real-life experiences and meaningful context that build a base for the abstract written problems we usually pose on tests.

Invitation to Learn

Take all of the students into a gym or a room with lines on the floor. (If neither are available create lines on your floor, use stairs, or find points of reference in your classroom.) Give each student a pattern block (but don't use the rhombus, the most narrow block) and explain that they need to follow your instructions based on what their block looks like. Use the following instructions to sort the students by their blocks.

1. If your block is a polygon, move to the first line.
2. If your block has at least 4 sides, move to the next line (this should leave those holding triangles standing on the first line).
3. If your block has 6 sides, move to the next line (this should group the hexagons together).
4. If your block has 4 right angles, move forward 2 lines (this will group the squares).
5. If your block has 4 equal sides and 2 acute angles, move forward 3 lines (this will leave the trapezoids alone)

Talk about how everyone moved at first, because they have one thing in common, but then found that they had differences. Discuss how the trapezoids, squares, and parallelograms were alike and different. Make sure to point out how the triangle is similar and different. After discussing, collect the shapes and return to class to begin the lesson. This activity will work with a variety of objects, but you should be able to get into groups in less than 6 steps or it will get too complicated.

Instructional Procedures

Materials

- ❑ Pattern blocks
- ❑ Student journals

1. Explain that classifying is a way to organize animals, plants, and objects. It helps to see how things are similar and different.
2. Talk about how everyone in the room is similar, yet different and we can put them into groups based on these similarities and differences. Give an example (Jenny and Penny are both girls but one has brown hair and the other blonde, so they could both go in the girl group but they could be separated into hair groups). Then allow students time to point out as many similarities and differences as they can.
3. Ask students to talk with their group about how they would group the class. Give them about 2 minutes to talk and then ask them to write their ideas into their journal. Students write the different groups they would use.
4. Guide the students through grouping the class. Allow students to volunteer the groups they thought of and have students get up and move into these groups. This allows students to see the groups and to clarify their thoughts. Divide the class into 3-5 groups. After finalizing the groups, have the students write these groups into their journal. Students should include the names of the students who fit into each of these groups for reference later.

5. Model how to write a classification key to describe the student groups. Use poster paper (plain or graph paper). Say each step e.g., 1. if you are a boy go to question 2a, if you are a girl go to question 4a.
6. After writing the classification key, show students how to use it to find each group.

Assessment Suggestions

- Have students copy the classification key into their journal and explain how to use it.
- Play guessing games. Use the clues on the classification key to guess different students around the room. Allow students to do both clue giving and guessing.
- In math, have students group numbers or objects and write about the groups.

Curriculum Extensions/Adaptations/ Integration

- A dichotomous key is easier to use at first. If students have a hard time following your model of a classification key, make a dichotomous key first. Then use the dichotomous key to write your classification key.
- Students that understand how to use the classification key can create a new key using the students in the room in different groups. They can present their key to their groups.
- Have students pull off a shoe, coat or backpack to use for grouping to repeat the activity if students are still struggling with the concept.

Family Connections

- Ask students to group their family the same way they grouped the class.
- Have students complete a survey or interview about how people use classification during their everyday lives. Create a bulletin board to show the other ways it is used in real life.

Keys and Classifying

Science Standard V

Objective 3

Standard V:

Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 3:

Use a simple scheme to classify Utah plants and animals.

Intended Learning Outcomes:

1. Use science process and thinking skills
4. Communicate effectively using science language and reasoning

Content Connections:

Science V-3; Creating a classification key

Connections

Background Information

Classification is the scientific process of organizing organisms into logical groups. Students need to know that they can discover the identity of any organism by following classification schemes. These schemes focus on similarities and differences. Students need lots of experience classifying anything and everything. By providing lots of exposure in various ways you provide more opportunities to succeed. This activity is more beneficial if taught multiple times using various objects for classification.

Research Basis

Wolfe, P. (2001). Brain matters: translating research into classroom practice. *Association for Supervision and Curriculum Development,* Alexandria, VA.

Writing should be combined with other learning activities to provide different cognitive experiences. Having students write their results or procedures extends the scientific thinking, because writing is a more complex skill.

Marzano, R.J., Pickering, D.J., Pollock, J.E. (2001). Classroom instruction that works: Research-based strategies for increasing student achievement. *Association for Supervision and Curriculum Development*, Alexandria, VA.

Comparing, classifying, and identifying similarities and differences are effective instructional methods that encourage scientific thinking.

Invitation to Learn

Invite students to pretend that it's 2030 and we know aliens exist. Explain that 3 alien ships were fighting and they shot each other down. The remnants of the ship are in the desert and need to be cleaned up. The officers want to bury the bodies of the aliens with their ship,

but the aliens are scattered all over the place. The officials need your help to determine which aliens went with which ship. Pass out the *Alien Cards* and *Alien Organizer* to each group. Ask groups to cut out the pictures and put them in the column with the ship they traveled in. *The idea is for students to group aliens with the similar symbol into the ship with the same symbol.* After allowing time for groups to work, have them share their findings with another group and defend why they did it that way. Discuss how students determined the ship to put each alien.

Instructional Procedures

Materials

- ❏ *Alien Cards*
- ❏ *Alien Organizer*
- ❏ Sorting objects
- ❏ Students journals

1. Have students get out their science journals. Explain that they are going to do a Quick-Write. The purpose is for students to write for 2 minutes about classification, to get them thinking about the topic, drawing out any prior knowledge. Tell the students that you want them to write the whole time because sometimes we get more ideas as we write our current ideas down. Sometimes this means they will be writing about other things, but encourage them to keep it as close as they can to classification. This might take practice to keep them writing for 2 minutes (use writing time or do it every day before some lessons).
2. Explain that students are going to be learning about classification today.
3. Define classification as grouping objects according to similar characteristics. The purpose of classification is to provide a way to look at similar objects but know which is which through classification.
4. Model classification by taking a group of objects and sorting them.
   - Talk as you sort so students can hear your thinking.
   - Point out characteristics and similarities.
   - Name each group using the characteristics (make sure it relates to why those objects are in that group).
   - Defend the reason for making those groups.
5. Show students the other groups of objects and explain that they now have the chance to sort/group objects. Put the objects around the room and allow students to decide where they would like to work.

6. Explain that groups need to discuss and decide how to sort the objects. Then determine a name for each group of objects based on the characteristic for that group.
7. Allow groups time to work while you monitor and listen to their thinking. Make sure students are talking to each other. Ask questions where needed.
8. After sorting, ask groups to create a chart that shows the objects in each group and has a written defense for placing those objects together.
9. After all groups are completed, have a spokesman from each group travel to the other groups to share what they did. The spokesman moves in a clockwise motion and spends about 30 seconds at each group.
10. Model how to single out each object. If the group has more than one object, then they need to single each object by a difference. Show how each object is in the same group but a little different. Then give each object a name.
11. Allow each group time to single out and name each object.
12. Show students a classification key and explain that scientists use it to identify objects. Model how a classification key works. Show students how to read the characteristic and then look at the object to determine if it fits the characteristic. Then follow the directions on the key.
13. Model how to write a classification key for your objects. Make sure to focus on characteristics (if an object is round go to 2a, etc.).
14. Have groups create a classification key for their objects. Provide assistance and support as needed.

Assessment Suggestions

- Written assessment: Students must describe their groups and defend their reasons for making those groups.
- Performance and written assessment (can be done individually or as a group): Provide students with a new collection of objects, have them group them and create a classification key. (See rubric.)
- Use the Quick Write as a pre-assessment. At the end, ask students to answer the question again to see if understanding has changed, improved, deepened, etc.

- Have students create a classification key and then pass it on to a neighbor. The neighbor must use the classification key to identify the objects. To go even further, the neighbor could provide feedback on whether the key was helpful or if more work needed to be done.

Curriculum Extensions/Adaptations/ Integration

- Provide a center for students who finish early to continue with the same activities by grouping new objects and creating classification keys. They must have someone use their key successfully.
- For early finishers provide a classification key and an object. Students must identify their object using the key.
- If students are struggling, make sure they continue to work with a student who knows how to create the key successfully.
- If students are having trouble spelling or writing, allow them to record the instructions or script them to another person.
- Sort words by homophones, prefixes, suffixes, plurals, etc. Students group the words and identify similar characteristics.
- Show a group of numbers and have students sort them based on mathematical characteristics (try to avoid the shape or size of numbers). e.g. (2, 4, 5, 9, 12, 13, 20. 2, 4, 12, and 20) would be in the even group. (5 and 13) would be in the prime number group. (9) would be in the square number group. Students could also sort different types of fractions by congruency, less than ½ or larger than ½, etc.
- Give students different triangles to sort by angles, types, or sizes.
- After reading a story with lots of characters, have the students group the characters together.
- Group books/stories by genre, plot, setting, theme, etc.

Family Connections

- Ask students to classify something from their home. Pass out *Home Classification Sheet* to complete as they classify.
- Have students teach the alien classification activity to someone else in the family. A family member sorts the aliens, the

student write about what the family member did, and the family member signs off.

- Assign students to write a paragraph explaining what classification is and how to create a classification key.
- Students create a classification key using objects at home and share the key with a fellow student the next day at school.

Additional Resources

Books

Linking Science and Literacy in the K-8 Classroom, NSTA

Web sites

http://www.sciencenetlinks.com/lessons_printable.cfm?DocID=87

Lessons on classification and a great online classifying activity (Touch of Class E-Sheet)

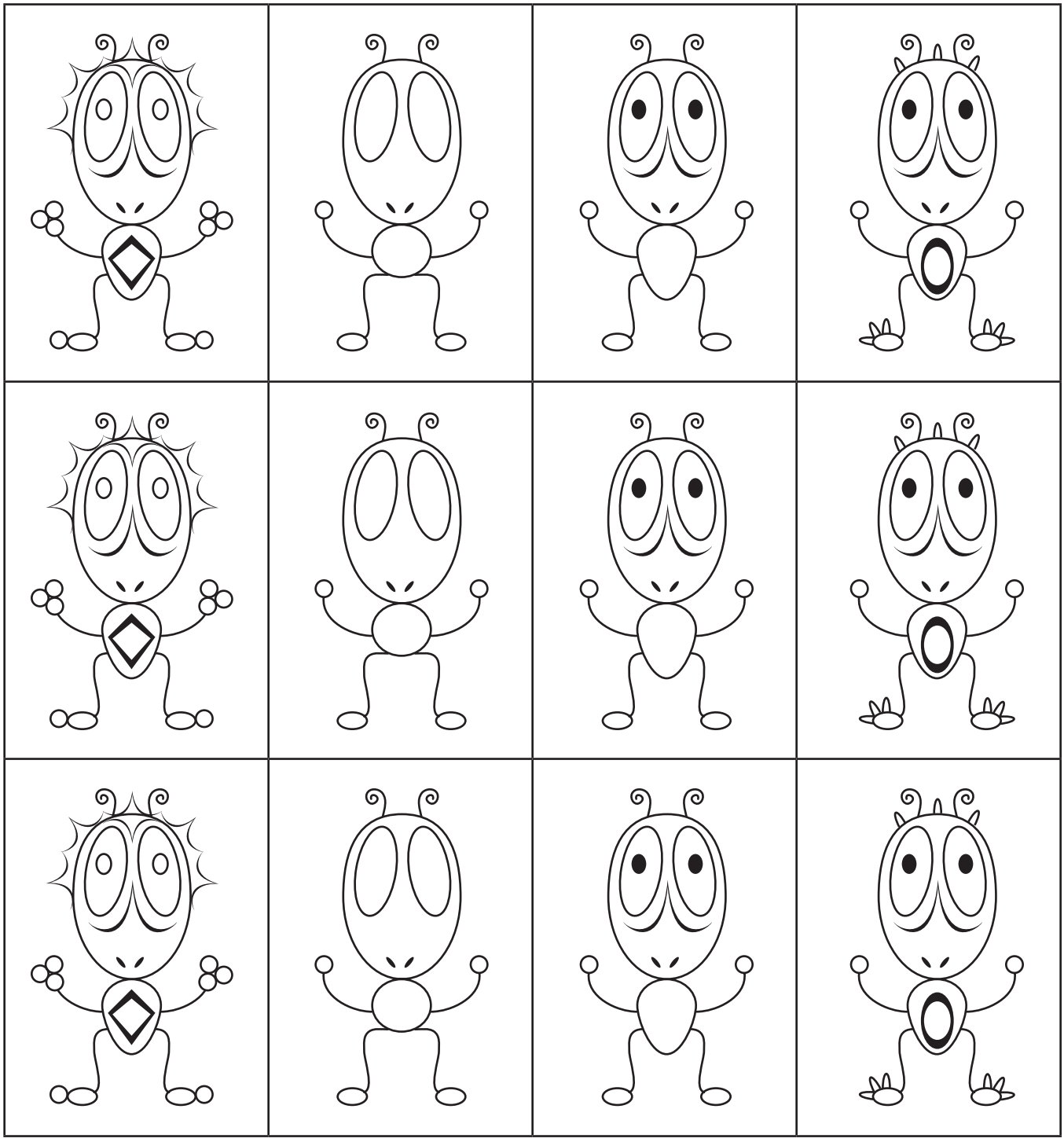
http://www.microbeworld.org/resources/experiment/experiment_creepy_critters.aspx

Fun classifying alien activity

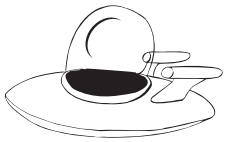
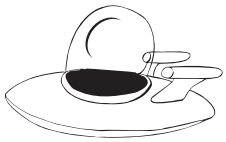
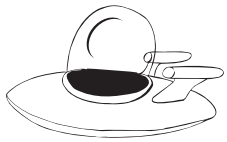
http://www.sciencelinks.com

National Science Teachers Association, www.nsta.org

Alien Cards



Alien Organizer

Ship #1 	Ship #2 	Ship #3 

Rubric for Classification Key

	1	2	3	4
Format	The key has no format. Characteristics are unclear and reader has no idea how to follow the key.	The key has some format and the reader can read and follow parts of it. The characteristics are unclear.	The key is mostly formatted correctly. The characteristics are clear and the reader can mostly follow the key.	The key follows the correct format, with each characteristic clearly labeled. Directions tell reader exactly where to go.
Use	The key was difficult to use and confusing.	Parts of the key were confusing and difficult.	Most of the key was easy to use, but some parts were still confusing to use.	The key is easy to use and very self-explanatory.
Neatness	The information is disorganized and messy. Conventions are missing.	Parts of the information are disorganized without any conventions. Parts are neat.	Most of the information is neat with mostly correct conventions.	All information is neat and conventions are correct.

Name _____ Date _____

Home Classification

1.	Find at least 10 different objects that you can group. Write those items here.
2.	Now group those items. Then draw the groups and give them a title.
3.	Include a written description of the characteristics of each group.

Why Do You Classify This?

Standard V:

Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 3:

Use a simple scheme to classify Utah plants and animals.

Intended Learning Outcomes:

1. Use science process and thinking skills
3. Understand science concepts and principles

Content Connections:

Science V-3; Classifying animals

Science Standard V

Objective 3

Connections

Background Information

Classification is a way to organize information in a hierarchal order. It helps students to see that animals and plants have similarities and differences, for example a bear is an animal and a mammal, but a frog is an animal and a amphibian. Students need to see that animals can be grouped by characteristics that are seen and are not seen; e.g. cold-blooded can't really be seen, but fur can be.

This lesson is to be used after the students have been exposed to many classifying activities. They should be familiar with grouping and simple classification keys.

Research Basis

Wolfe, P. (2001). Brain matters: translating research into classroom practice. A*ssociation for Supervision and Curriculum Development*, Alexandria, VA.

The brain processes abstract information best after experiencing real things first and then symbolic representations. To analyze and compare information, the brain needs to be able to base it on an experience. When learning science, students need to be presented with real-life experiences and meaningful context that build a base for the abstract written problems we usually pose on tests.

Invitation to Learn

Have students rip and fold a piece of paper in their journal to create a flip chart. Ask students to think of an animal they know well, one that they can picture in their mind and describe. Explain that students are going to create a character sketch of the animal. They will describe what the animal looks like, acts like, and places

Materials

- ❏ *Animals Cards*
- ❏ Animal pictures
- ❏ *What Can You Do With a Tail Like This?*
- ❏ Student journals

where it would live. This sketch should give information about the animal without ever saying the name of the animal. Give students time to complete their animal sketch. Encourage them to include LOTS of detail and write in complete sentences. After completing the animal sketch, have students write the name of the animal on the inside of the flip chart. If they finish early they can draw a picture as well. *If you want to carry this into more writing practice students can revise and edit as partners and then present to a group.*

When all students are done, have them share their animal sketches. Students stand up and walk around until the teacher says stop. They turn to the person closest to them and take turns reading their sketch and having the other student guessing the animal.

Instructional Procedures

1. Show the students the book *What Do You Do With A Tail Like This?* Explain that this book talks about similarities in animals like tails, eyes, hands, etc (show pictures/example from the book). Then it talks about how these parts can be different and how they are used.
2. Explain that before you read the story you want to see how much the students know about animals. Pass out the Animal Cards. Assign partners or 3 students to work together. Give the students a few minutes to walk around looking for their matching cards. When they are done talk about what matches they found. Post the matches on a poster for reference.
3. Read the book to the students. Stop and observe matches when they apply to the story. Have students correct themselves when necessary.
4. Explain to students that scientists look at what is similar and different in animals to classify, just like with the grouping activities done before. Explain that today students will get to group pictures of animals into similar groups and defend their reasons. The process should mirror how they have been classifying objects previously.
5. Pass out animal picture cards. Pictures can be grouped in various ways depending on how much your students have already learned about animals. If they know what the differences between reptiles and mammals are, you can have some of both in a group. But a little more challenging is to have a group of spiders, birds, etc. That way, students can focus on characteristics that make the animal unique from other

animals similar to it. Students work in groups to classify them. Encourage students to look at all characteristics.

6. When the students have created groups, help them to make a classification key to show the animals.
7. Assess students as you move through the groups. If students need more practice have them switch cards and repeat the activity with different animals.

Assessment Suggestions

- The *Animal Cards* provide a pre-assessment of students' knowledge of animals and their adaptations.
- Give students a classification key and an animal/plant to identify.
- Students explain how to use a classification key and why they are important.

Curriculum Extensions/Adaptations/ Integration

- Have students gather and group leaves. Include leaves that are native to Utah.
- If your students need more hands-on or kinesthetic activity, have them group stuffed animals instead of pictures.
- Use the internet to have students research about animals. They can write a report or give an oral presentation.
- Use the jigsaw activity to learn about animals. Have groups of students learn about an animal (or group) through the internet, books, etc. Then regroup students so that each animal is represented in the group. Have them give an oral presentation.
- Focus classifying animals or plants from specific habitats. Students group the animals from wetlands, deserts, and forests. Then discuss differences in the adaptations that the animals have to survive.
- Students can write as if they are the animal and explain what life is like.
- Students can create a daily diary as if they were an animal living in the forest, wetland, or desert. (Use *Diary of a Worm* to encourage ideas.)

Family Connections

- Teach a family member how to use a classification key.
- Use a simple plant classification key to identify trees around their homes.
- Give students a classification key and animal pictures; they must identify the animals.

Additional Resources

Books

What Do You Do With a Tail Like This?, by Steve Jenkins and Robin Page; ISBN-10: 0-618-25628-8

Web sites

www.thefuturechannel.com

Great information and videos about animals and scientists. It covers many science topics.

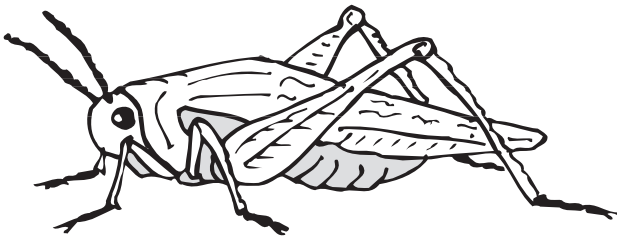
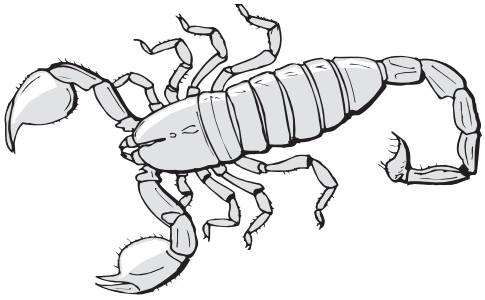
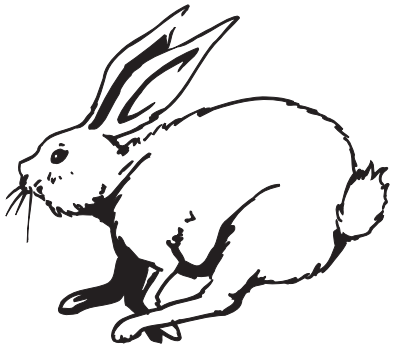
www.wildlife.utah.gov/projectwild/

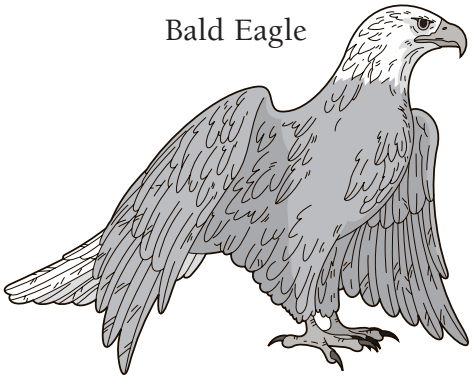
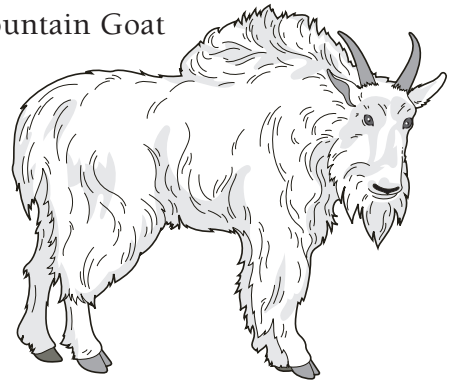
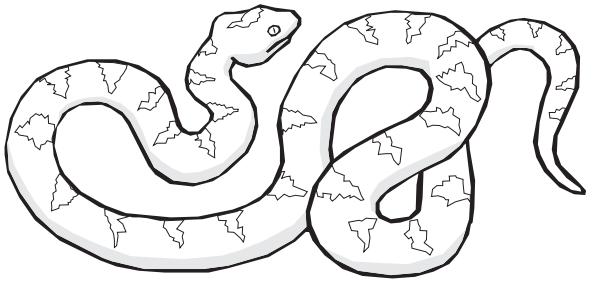
Information about Utah wildlife, includes activities and resources.

Organizations

Project Wild, Diana Vos 801-538-4719, DianaVos@utah.gov

Animal Cards

Cricket 	An insect that chirps by rubbing its wings together. It jumps and has 6 legs. It has a hard body; an exoskeleton.
Skunk 	This mammal sprays its attacker with a stinky, eye stinging liquid. Its fur is black with a white stripe. It is an omnivore.
Scorpion 	This insect eats spiders and small mammals by poisoning its prey with a stinger on the end of its tail. Its exoskeleton is red and it lives in the deserts of Utah.
Jackrabbit 	This mammal lives in the deserts of Utah. It has very tall ears and a small bushy tail. It eats grass and shrubs.

Bald Eagle 	This bird has a white head and sharp claws. It dives from the sky to attack its prey, such as rabbits, small birds, or fish.
Mountain Goat 	This mammal has short horns and fluffy fur. It lives in the mountains and its hooves help it to climb steep, rocky slopes.
Snake 	This reptile has no legs and slithers on the ground. Some can unhinge their mouth to swallow their prey whole.

Appendix

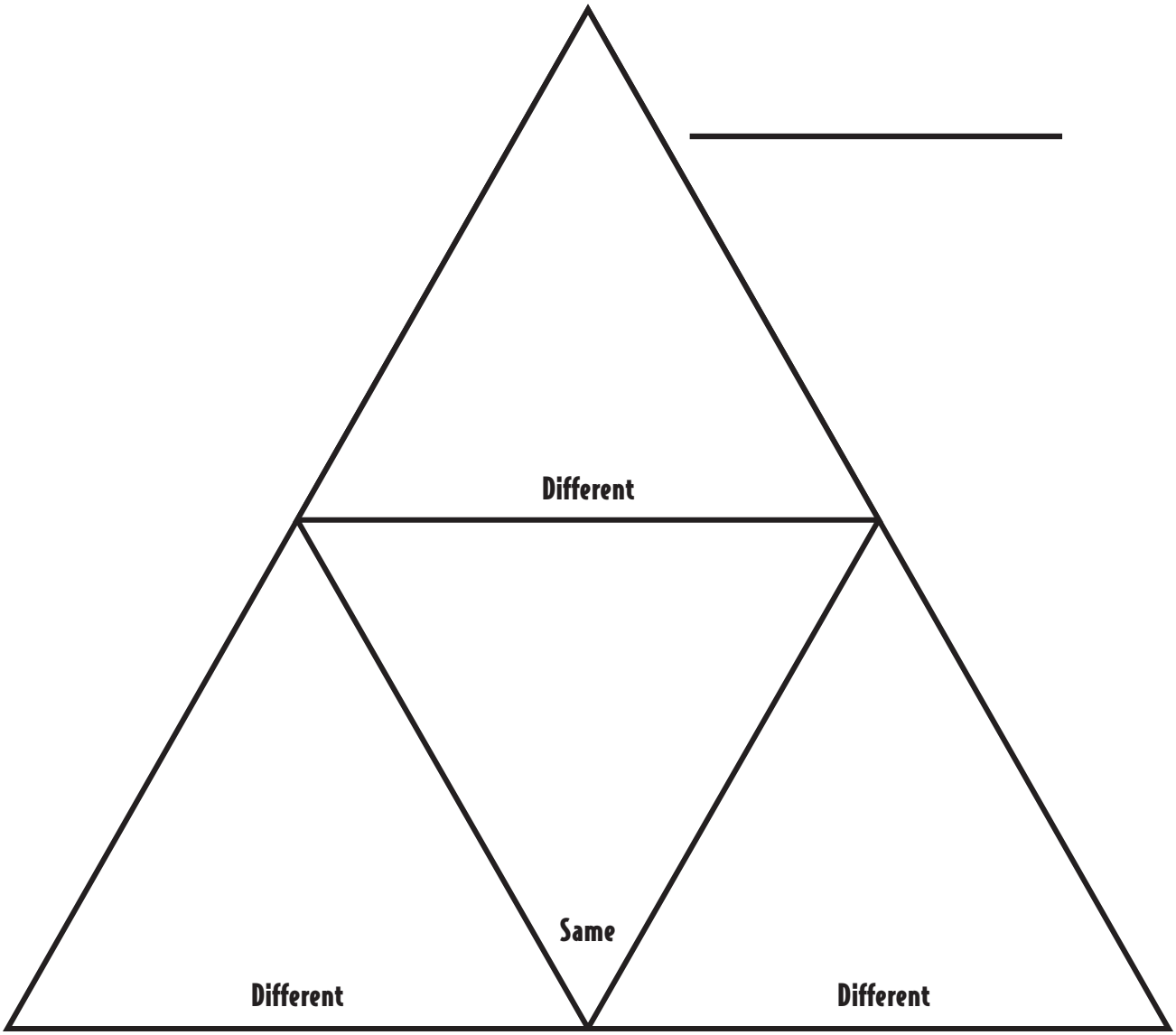
Name _____ Date _____

Compare and Contrast

How Are They Different?

How Are They Different?	How Are They Different?	How Are They Different?

Triangle Compare and Contrast



Name _____ Date _____

Rectangle Compare and Contrast

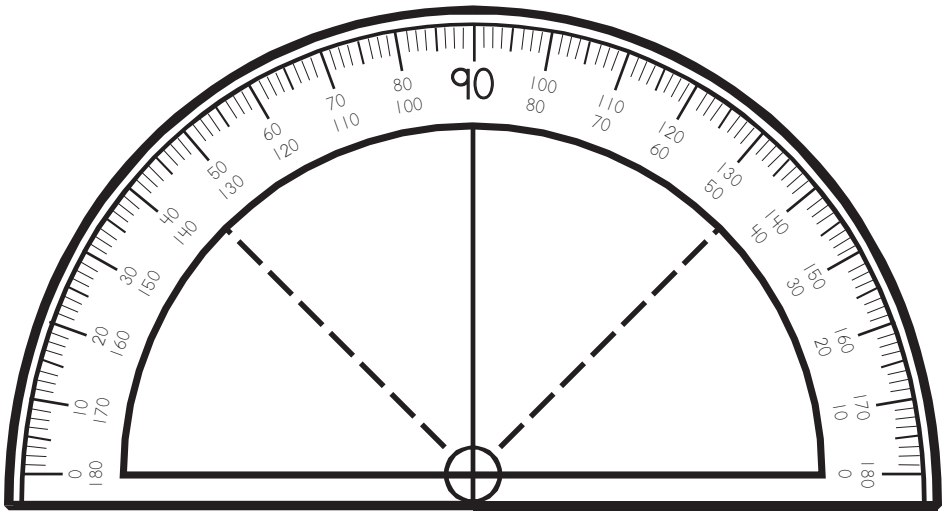
_____ _____

Different	Same	Different

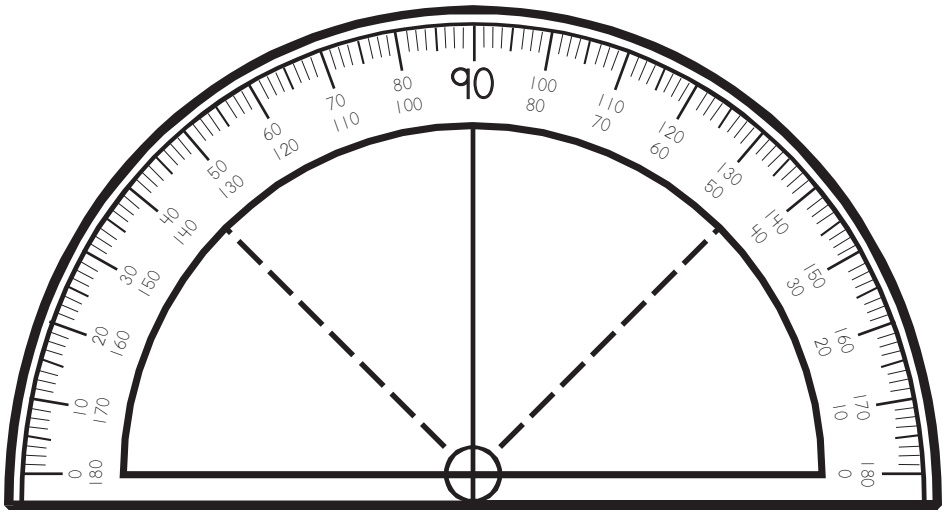
Mystery Word

R	C	R	A	P	T
R	O	T	O		

Label a Protractor



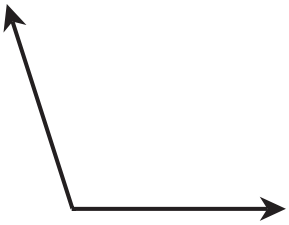
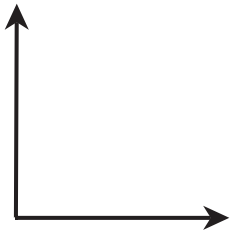
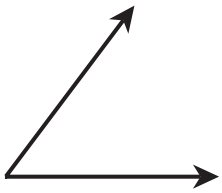
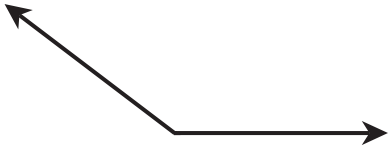
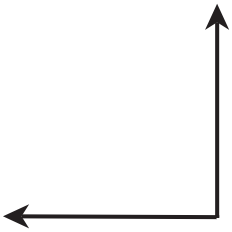
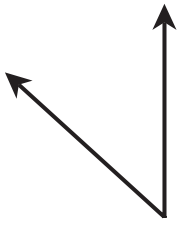
Making My Protractor



Name _____ Date _____

What's My Angle?

Identify the angle. Use a protractor to measure the angle and record.

1.  Angle _____ Degrees _____	2.  Angle _____ Degrees _____
3.  Angle _____ Degrees _____	4.  Angle _____ Degrees _____
5.  Angle _____ Degrees _____	6.  Angle _____ Degrees _____
7.  Angle _____ Degrees _____	8.  Angle _____ Degrees _____

Photomat

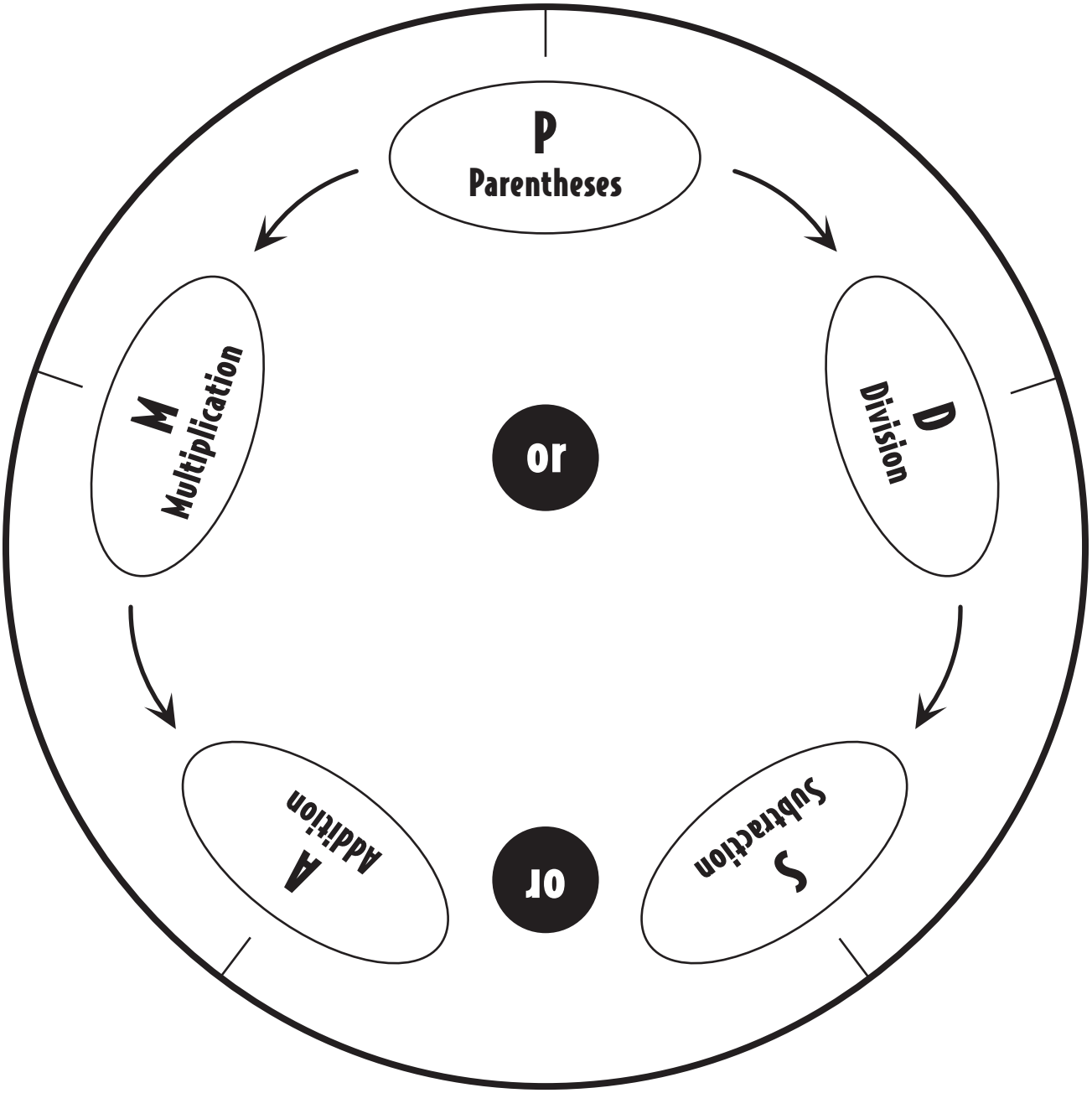
Place Rock Here	Place Rock Here
Name _____ Date _____ Mass _____ Length _____ Width _____	Name _____ Date _____ Mass _____ Length _____ Width _____
Place Rock Here	Place Rock Here
Name _____ Date _____ Mass _____ Length _____ Width _____	Name _____ Date _____ Mass _____ Length _____ Width _____

Name _____ Date _____

Take a Tumble Journal Rubric

	4	3	2	1
Measurements	Includes mass, width, length, and volume measurements.	Is missing one measurement.	Is missing two measurements	Is missing more than two measurements.
Visual Description	Includes specific visual characteristics of shape, color, and identifying marks. Uses complete sentences.	Includes specific visual characteristics of two of the three categories. Most sentences are complete.	Includes general visual characteristics of two or more categories. Some sentences are complete.	Includes visual description of one characteristic. Most sentences are fragments.
Predictions/ Observations	Includes a specific prediction of how the rock will change, and a specific observation of the actual changes.	One prediction/ observation is specific. The other is general.	Both the prediction of change and the observation of change is general.	Includes either a prediction or an observation of change but not both.

Order of Operations Compass



Alien Organizer

Ship #1	Ship #2	Ship #3